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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Concrete Bridges and Culverts
By H. GRATTAN TYRRELL
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Fulfills Every Engineering Requirement.

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CHICAGO
NEW YORK
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PITTSBURGH
DENVER

GRANITE
THE MOTOR TRUCK HIGHWAY

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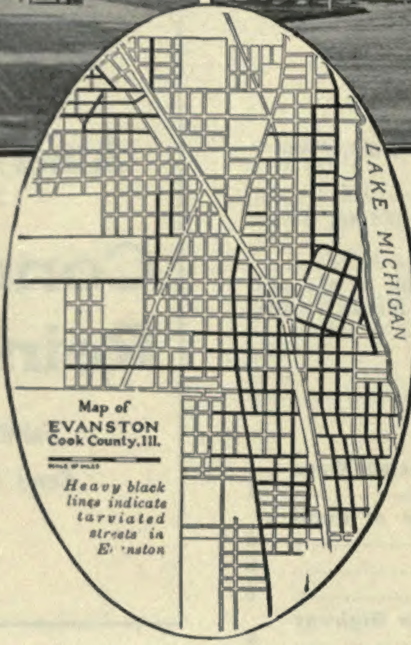
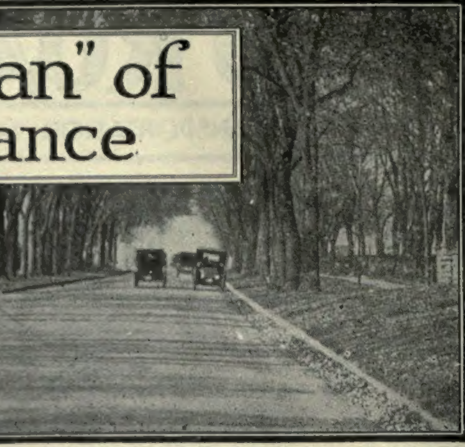
GRANITE PAVING BLOCK
MANUFACTURERS' ASSOCIATION
OF THE UNITED STATES, INC.
JAMES J. TOBIN, FIELD ENGINEER
31 STATE STREET BOSTON, MASS.

The "Evanston Plan" of Street Maintenance

Orrington Ave., Evanston, Ill., Old waterbound macadam surfaced with "Tarvia-A" June, 1919.


LAKE MICHIGAN
Map of EVANSTON Cook County, Ill.
Heavy black lines indicate tarviated streets in Evanston



Sheridan Road, Evanston, Ill. One of the Improvement Association Streets, constructed with "Tarvia-A" in 1915-1916.

WITH natural pride in their beautiful city, which lies just north of Chicago, the property owners and city authorities of Evanston, Ill., have worked out what has come to be known as the "Evanston Plan" for keeping their macadam streets in first-class condition.

The property owners on many streets have local Improvement Associations, who voluntarily contribute to the cost of maintenance of their street. This fund was formerly used for street sprinkling, but is now being used in systematic Tarvia maintenance. The work is handled by the street department under the direction of the Commissioner of Streets. This has worked out so satisfactorily that some of the Associations have a surplus in their treasury, where formerly all the funds went into street sprinkling, and the streets are dustproof, waterproof and automobile proof.

Keeping Ahead of Old General Neglect

The policy of the City of Evanston is to repair and re-treat the streets *before it is absolutely necessary.* Three patrol gangs are kept on the streets all summer, immediately patching any spot in the macadam that begins to show signs of wear. As a result, the entire system of more than a half million square yards of Tarvia-treated macadam pavement is kept in wonderful condition all the year round.

In fact, the streets of Evanston form a striking testimonial to the efficiency of systematic Tarvia treatment and low cost maintenance.

The Efficiency of Barrett Service

The present Commissioner of Streets, Mr. R. M. Brown, writes as follows:

> "Efficiency of service by your company in the delivery and application of Tarvia to the City of Evanston during the past season has been very satisfactory.
>
> I assure you that your efforts in our behalf are appreciated, as we are able to keep our pavements in good serviceable condition despite the fact that they are subjected to unusually heavy traffic."

Property Owners Prefer Tarvia

Former Commissioner of Streets Mr. Walter W. Krafts, before leaving office, wrote as follows:

> "The people of Evanston are satisfied in every respect, and in asking for work to be done on streets, are asking for Tarvia in preference to other binders."

The Evanston plan of street maintenance is attracting a great deal of attention in other municipalities.

We should be very glad to explain this plan in greater detail to any interested city official or property owner upon request. In writing, address the nearest Barrett Company office.

Tarvia

Preserves Roads–Prevents Dust

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by any one interested. If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will be given prompt attention.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Old Series, Vol. LX
New Series, Vol. XXI

JAMESTOWN, N. Y., JANUARY 5, 1921

Number 1

The Use of Asphaltic Concrete for Resurfacing Worn Pavements**

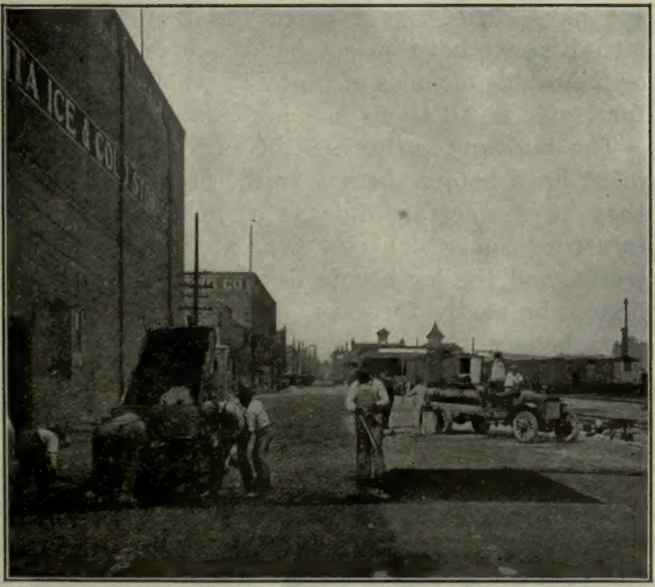
By P. S. BROCKWAY†

Our method of preparing old brick pavement for resurfacing involves the removal of all disintegrated brick from the surface and replacing with cement surface built up to the bottom of the wearing surface. We have ordinarily placed the paint coat by sprinkling on with a sweeping movement with an old broom. We use only a light covering and have thought that it might be dispensed with entirely, as there does not appear to be more need for it than if the surface were laid on an ordinary concrete base.

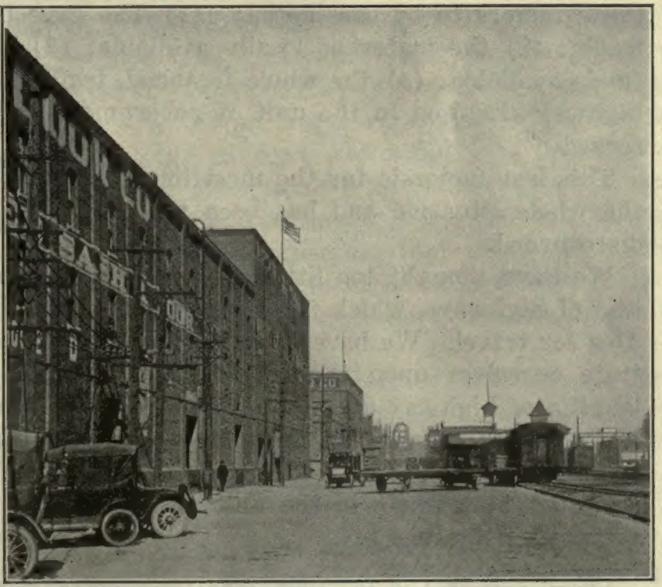
We heartily approve of requiring a binder course of varying thickness, laid ahead of the surface in order to permit the laying of the wearing course with uniform thickness. This is very essential if the pavement is to be left smooth after rolling and an extremely important point in the construction of soft top pavement.

We have used this method in restoring to usefulness an old brick pavement on one of the heaviest traveled streets in the industrial district of our city with great success.

A word in regard to our practice in the mixing of the surfacing for this character of traffic might not be amiss. In order to stiffen the surface against rutting and cutting in hot weather, we have used asphaltic cement having approximately a penetration of 45 at 77° F. We have specified from 10 to 12% of limestone dust, or Portland cement passing the 200-mesh sieve, and use approximately 20 to 30% Joplin chat retained on a No. 10 sieve, and from 9 to 10% of asphaltic cement. The other material consists of



Applying the Resurfacing Material



View of Completed Pavement

ROCK ISLAND STREET, WICHITA, KAN.—RESURFACED WITH TEXACO ASPHALTIC CONCRETE

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*Paper presented before the Kansas Engineering Society.
†City Engineer, Wichita, Kan.

a mixture of fine and coarse sand. This mixture is really a compromise between the usual asphaltic concrete and the sheet asphalt surface. We believe that this mixture will be hard enough and stiff enough to successfully stand up for a number of years under severe traffic conditions, providing the foundation is solid and the old surface repaired with considerable care before laying the wearing surface.

We have believed for some time that the time will come when there will be very little difference between a sheet asphalt specification and an asphaltic concrete specification and that the ideal pavement is the mean between the two. A characteristic failure of sheet asphalt surface is the development of ruts under intensive traffic. Waves and shoves are formed, due to internal flowing of the material under traffic impact because of insufficient cohesion resistence to this flow, and also because of the asphaltic cement being too soft for the rapidly increasing heavy loads moving at high speed.

The characteristic failure of ordinary asphaltic concrete, on the other hand, lies in the development of cracks and crumbled patches, and consequently disintegration by the admission of moisture into the body of the pavement. This failure is produced by too great a degree of hardness, too small an amount of lubricating matrix, or a mixture not balanced properly to produce the greatest density. Naturally, these conditions are corrected by adding more asphaltic cement, increasing the density by the addition of more fine material and grading up in a straight line curve to the largest material, reducing this to a practical working basis. Such procedure is equivalent to the making of a sheet asphalt mixture and building it up.

In stiffening the sheet asphalt mixture, larger sized angular chat or similar material is added, thereby increasing the natural resistance to flow.

In 1919 we resurfaced several old brick and other pavements, using asphaltic concrete and old sheet asphalt so mixed as to produce a mixture as outlined above. The results obtained have been so satisfactory that we expect to continue this practice on streets carrying heavy traffic, even though it is rather a radical departure from general practice.

Relative Service Value of Different Types of Rural Pavements—III*

By A. R. HIRST†

(Continued from December 29)

The Traffic Problem and Service Value.—In considering the relative service value of pavements one cannot disregard the matter of expediency. There are, when considering a road problem and when determining an economical type to be used, always these factors to be considered: (1) The expected traffic; (2) the materials locally available; (3) the funds available; (4) the whole financial, traffic and highway situation in the unit of government to be served.

This last factor is far the most important one in the whole situation and has been too often totally disregarded.

We have thought too little about the basic function of highways, which is, of course, to offer facilities for travel. We have been too prone to concentrate ourselves upon the consideration of specific lengths of highway and upon an endeavor to economically design and build these lengths, rather than concerning ourelves with the more important traffic situation as a whole in the unit of government in which we operate.

We have been content to design and build a few miles of highway each year and to look forward into the far distant future with the hope that some day the contemplated system would be completed and traffic would be free to come and go as it pleased. We have closed our eyes to the fact that in the meantime we have on our hands scores or hundreds or thousands of miles of highway which are difficult for traffic at all times and impassable at some.

The highway authorities of each unit of government have before them a traffic problem. That is, they have a certain mileage of highways in a certain condition which now bear a certain amount of traffic, and the legitimate development of this traffic can be partly foreseen. They have available or they believe that there can be made available in a definite period, which they can select, a certain sum of money. Of course, the sum of money which may be made available is contingent upon certain circumstances usually beyond the control of the authorities. However, they can analyze their traffic problem, and their highways, and can assume the sum which they must have, and which they believe they can get within a definite period of years, and can then determine about what should be done with this money, so as to give their clients, the public in that unit of government, the best result in traffic service during the designated period.

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*Paper presented at the sixth annual convention of the American Association of State Highway Officials, Washington, D. C., Dec. 13-16, 1920.

†State Highway Engineer of Wisconsin.

I don't know whether I make myself clear or not, but the point I am trying to drive home is this: Far more important than the mere selection of a truly economical type of construction for assumed conditions on a specific highway is the importance of determining upon that program of improvement which will be of the most benefit to the traffic in a designated area.

The schoolman has so obsessed us with his ideas of so-called true economics in pavement construction that we have been inclined to lose sight of the much more important economics of the traffic situation as it exists and may be expected to develop. We have had dinged into us the importance of economic design of specific stretches to such an extent that many of us have lost sight entirely of economic design for a traffic situation.

If unlimited funds, labor, and materials were always available it might be possible that the schoolman is right and that we should never build anything but the truly economical surface, but there is always a limit to the funds which can be made available or which can be expended in a specific term of years, and the true economics of pavement design is to find the solution which gives the least cost, not only of the construction and maintenance of the pavement, but of the carrying of traffic in the designated area within the designated period.

I may be able to make my idea clearer by giving a short illustration.

Normal County has 200 mi. of road of the gravest importance; 200 mi. of secondary highways, important from the county standpoint; and 400 mi. of strictly local highways, cared for by the local units of government.

Outside of the funds which can be made available for the general maintenance of this 800 mi. of highway, it can be foreseen that in the next five years the total funds available for highway improvement in Normal County will be $4,000,000. Of the 200 mi. of first class highways, 50 mi. have been surfaced in the past and are still maintainable; 150 mi. are earth, without hope of redemption. Of the 200 mi. of less importance, 20 mi. have been surfaced, and 180 mi. are earth. Of the 400 mi. of local roads, all are earth. Traffic conditions are at present intolerable in the county. Each rain means a blockade; each spring and rainy season an absolute cessation of traffic, except by team and that traffic is almost blocked.

The $4,000,000 available in the five years will, it is estimated, build 100 mi. of the schoolman's economically correct highway. If the public officials determine to build this type of highways, at the end of five years there will be 230 mi. of the first and second class highways (over 50% of the whole) still unsurfaced. Isn't it plain that this answer cannot be correct, regardless of the so-called economics of the specific instance? Isn't it plain that the public body controlling the money should most carefully consider the whole situation and spend the $4,000,000 in an effort to make at least passable the whole of the 400 mi. of principal highways?

The schoolman will say that some of the money is wasted because a portion of the types selected to be built are not going to exist for 20 or 50 years, but the economic waste incident to the use of (in his opinion) uneconomic types is not a marker to the economic waste incident to the continued use of a largely unimproved system of highways. In other words, the loss to traffic by the prolongation of such a situation is usually infinitely more than the loss to the public due to the construction and maintenance of types requiring renewal after a term of years. The schoolman will say that if $4,000,000 isn't enough, $10,000,000 or $20,000,000 should be raised, but our assumption is that the $4,000,000 is all that that community can possibly be sold within the given period, and the limit of selling to a community can be pretty well analyzed and defined by the public officials of the community.

Carried to a logical conclusion, some one will say, this plan means building largely temporary surfacings and later on building again. It does! And why not, if that is the true economic solution?

Most of our railroads have been rebuilt more than once. The old railroad men thought not much further than the traffic there was in sight and the distance they had to build to accommodate this traffic. They then mustered all the money they could get or that the economics of the situation justified and built the best they could build with the funds available, usually using local materials to reduce the cost. But they built the whole way and carried traffic through. As it grew and intensified, and as the country developed so that it could pay for better transportation, thus justifying larger expenditures and better structures, the railroad was rebuilt. I believe we must proceed along exactly similar lines—first accommodate traffic, building to the money which can be made available, expecting that after the traffic is gotten through and the adjacent territory reaches fuller development, the necessary betterments will follow.

From the mere standpoint of mechanical performance alone only so many miles of high class highway can be built each year. One can multiply this annual possible mechanical performance by ten and in the ordinary state the total will not equal the number of miles of primary highways now partly impassable which should be made passable. In other words, the economically perfect system required to properly serve traffic cannot possibly be built in ten years in the average state. Are we in the meantime to allow the unbuilt portions to go totally unsurfaced and uncared for because we are crying for the moon of absolute perfection? Wisconsin is not waiting and I miss my guess if many of the other largely unpaved states are going to wait for that millennium. Traffic must be served!

Federal Aid Types and Service.—There has been considerable criticism by certain wiseacres to the effect that a large proportion of the federal aid construction is going into low class structures and that therefore (Q. E. D.) the funds are being wasted. Ninety per cent. of these worthy critics never designed or built a highway in their guiltless young lives, nor have they ever tackled a legislative body to get it to finance one.

Wisconsin is among the list of states which are summoned to the bar to show cause why they should not be slapped on the wrist for building other than permanent (God save the mark!) highways with federal and state money. There has been some doubt in these worthy gentlemen's minds as to whether we and our fellow criminals should be just simply hung, or whether it would be kinder to confine us in some of the penal or charitable institutions of our good states.

Bless their hearts, it must be a grand and glorious feeling to know so much when one has had so little experience! This gift of intuition, this omniscience, this knowledge of all conditions without seeing them, this grasp of situations undreamed of must indeed be a marvelous gift! I regret that all of us do no possess it.

For Wisconsin, we have no apologies to offer. About 19% of our total mileage of federal aid construction will be concrete, 2% macadam, 42% gravel and 37% earth, with modifying surfacings to make them passable. Expressed in terms of money about 40% will go into concrete, the remainder into grading and other types. Every project solved a traffic problem and freed a community from the bondage of years of impassability or danger. No one can tell me, nor can he tell the communities in which the work was done, that the money was wasted. Our critics themselves, if faced with the same problems, would come to the same decisions if they have 10% as much brain as they think they have.

Even our good friend MacDonald has allowed himself to be somewhat alarmed by the croaking. Possibly like the would-be frog magnate he has mistaken noise for numbers. I assume that other states have determined, like Wisconsin, to serve traffic rather than to slavishly adhere to certain so-called ermanent types exclusively. Much of the criticism has come from those retained by certain pavement interests. Naturally if we do not construct their type of pavement we are necessarily wrong and probably insane or crooked.

We hope that all states will hold to safe ground and serve traffic now. Deviation from this policy s more apt to waste money than is adherence to it. Probably more federal and state money has been wasted in prematurely building unnecessarily expensive types of surfacing than has been wasted in grading and building the lesser surfacings. After all, the one thing that is permanent about road work, the one thing that can not be done too well or too soon, is proper grading on correct locations. Those states that are feeling their way by doing much of this kind of work at places where traffic has been previously stalled by grades or drainage conditions are not wasting money—they are truly investing it with profit.

Common Sense vs. the Slide Rule.—It may be inferred from this paper that it would take the brain of a Demosthenes, the genius of an Edison, and the engineering skill of a demi-god to determine what pavements should be built, given a condition, these theories, and a sum of money. Such is not the case. In four cases out of five a decision can be readily and quickly made when all surrounding facts and circumstances are known. It takes largely common sense and business judgment sufficient to grasp relative values. It is a matter of experience and judgment, rather than of the slide rule and arithmetic. We have used too much higher mathematics and too little common sense. We have sought to set ourselves upon a pedestal of economic perfection and have closed our eyes to many of the surrounding circumstances, until many of us cannot recognize a real economic fact when we meet it. The people are commencing to demand results rather than higher mathematics. They don't know much about pavement economics or relative economy of types, but they know when and where they were stuck in the mud and where they broke that last spring.

There are too many hundreds of millions of dollars invested in means of motor transportation, and too much pleasure, comfort, convenience, economy and time saving depend upon the immediate, economical and safe use of motor vehicles, for us to trifle with the facts as they exist. The owners of these vehicles demand service. They must be given it. This, despite the fact that many manufacturers of motor vehicles persist in pursuing the ignis fatuus of highly centralized highway systems and of highly concentrated construction. Automobiles and motor trucks are owned on almost every square mile of territory and use every main highway. They can not serve or attain complete efficiency unless they can get through everywhere—now! Why their producers should deliberately work to limit their use offers to me an enigma impossible of solution.

It would be nice indeed if we could serve traffic always and immediately with the ultimate, but it is

(Continued on Page 6)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI JANUARY 5, 1921 No. 1

THE COMING YEAR

In extending to its readers every good wish for the coming year, GOOD ROADS does so with complete confidence in the immediate future of road building.

Never, we believe, has the total sum at the disposal of the nation's road builders been so great as at present. Not only are there large unexpended balances available, but there are new appropriations from general funds and from bond issues.

In carrying out work this year contractors will be unhindered by the difficulties that they have encountered during the past few seasons in securing labor. Present indications are that the labor supply will be adequate and that lower prices will prevail.

Materials can hardly increase in cost and it seems not unlikely that costs will be lower. It is reasonable, too, to look for better transportation facilities and, therefore, less trouble from delayed deliveries.

Since activity in road betterment is governed by the demand for good roads, the work of the road builder depends upon public sentiment. This phase of the situation is entirely satisfactory. Public opinion is unmistakably for good roads. Not only is there a steadily growing demand from users of passenger cars, but there is an ever growing call for roads for commercial vehicles. Motor trucking has reached hardly realized proportions, but is yet only in its infancy.

All things considered, road builders should enter upon the work of 1921 with renewed courage and enthusiasm. There is every reason to look forward to a year of achievement unequaled by any that has gone before.

THE A. R. B. A. CONVENTION

Plans are practically completed for the annual convention of the American Road Builders' Association, which will be held at Chicago during the week of February 7th.

As in previous years, an exhibition of road building machinery and materials will be held in connection with the meeting. The selection of exhibition spaces began some time ago, and, according to reports from the headquarters of the association, has gone far enough, even at this early date, to indicate a display exceeding in number and variety the very successful shows held in Boston, Pittsburgh and Chicago in other years.

The officers of the association are also confidently expecting a large attendance. Road builders all over the country are looking forward to a busy season—one that though free from some of the difficulties that have hampered road work during the past few years, will still present its own problems. These must be met and overcome and road builders are alive to the benefit of the full and open discussions of road building problems that always comprise so large a part of the A. R. B. A. conventions.

RELATIVE VALUES OF DIFFERENT ROAD SURFACINGS

The lay public's quest for the "best road" and the highway engineer's studies to determine the type best fitted to meet a given set of conditions and his subsequent efforts to secure the adoption of that type have served as subjects of many erudite essays. And the whole discussion has been obscured more or less by the smoke screens thrown out by those with axes to grind.

Elsewhere in this issue is printed the third, and final, installment of a paper on the subject, which was presented at the recent meeting of the American Association of State Highway Officials by A. R. Hirst, State Highway Engineer of Wisconsin. Mr. Hirst treated the subject somewhat exhaustively, but yet with a frank conciseness of expression and clarity of argument that are refreshing. The meat of the paper is contained in the conclusions set forth in this last installment, but the whole paper is well worth the time required for its careful reading.

By no means all highway engineers will agree with Mr. Hirst—in fact, many will violently disagree. But notwithstanding these, the unprejudiced will have to admit that the paper contains a lot of mighty hard facts and that observance of some of the principles laid down would save engineers trouble and the public money.

Pennsylvania Buys Toll Road

With the purchase of the Johnstown-Cramer Turnpike in Cambria and Indiana Counties, Pennsylvania, only two other toll roads remain in the state. The Johnstown-Cramer Turnpike is 5 mi. long and was sold for $7,000, of which the state paid $3,500, Cambria County, $2,158, and Indiana County, $1,342.

Congress Favors More Federal Aid

Republican leaders of the House of Representatives have agreed upon an appropriation of $100,000,000 for federal aid, it was announced on Dec. 21, after an executive session of the House Roads Committee. It has not been decided, however, whether to make this amount available during the coming fiscal year or for the next two years.

A bill introduced by Representative McArthur, of Oregon, now before the Roads Committee, would make $400,000,000 of federal aid funds available during the next four years. However, it develops that the Republican Steering Committee has decided that in the interests of economy the appropriation should be limited to $100,000,000 and should not cover more than a two-year period.

Members of the Roads Committee state that they expect action on the roads program at this session of Congress. A sub-committee will hold hearings on the question after the holidays.

New Jersey May Abandon Use of Convicts In Highway Work

Convict labor on New Jersey roads will be withdrawn for the winter and it is very probable that the system will be permanently abandoned because of dissatisfaction with the results obtained. T. J. Wasser, State Highway Engineer, has reported to the Highway Commission that the work of the convicts has been characterized by a marked degree of inefficiency and that the costs of maintaining the camps have been excessive in comparison with the work accomplished. Free labor, said Mr. Wasser, is now becoming more plentiful in the northern part of the state where the two prison camps are located and little difficulty is anticipated in procuring men to take the place of the convicts.

Commissioner Whitemore concurred with the State Highway Engineer in opposing convict labor on roads.

Supervisors Convicted For Bad Roads

George Wise, Willard Markley and Frank Smith, Road Supervisors of Franklin County, Pennsylvania, were recently convicted for maintaining a nuisance in the form of a bad road in Metal Township.

$5,000,000 Bond Issue Authorized for New Jersey Bridge and Tunnel Work

The New Jersey Bridge and Tunnel Commission, in charge of New Jersey's interests in the Hudson River Tunnel between New York and New Jersey and the bridge between Camden, N. J., and Philadelphia, Pa., has authorized a $5,000,000 issue of 30-year 6% bonds. This issue forms a part of the $28,000,000 bond issue authorized by the recent referendum.

Relative Service Value of Different Types of Rural Pavements—III

(Continued from Page 4)

mechanically impossible. Until we can so serve it we must meet the situation which exists and get the best result we can with the means at our command. We will not often be divinely right, we may sometimes build highways which our grandchildren will not use, but, after all, the people living right now also desire to live and to be happy and to run and jump and play and work.

Let's not worry so much about our predecessors or our successors; let's do our best for our contemporaries. Service value doesn't necessarily mean the ideal for the next decade, it may better mean service value right now, taking all things into consideration, including the living as well as those who may be expected to come after the living. After all, our children and our children's children will probably be able to take care of themselves. The children's children of other ages always have.

A county or state highway department should not exist merely to design and build a few miles of highway and a few culverts and bridges. They should exist to give transportation service to their clients. They should strive to arrange the laws and their practice so as to give it now, not in 1950. The thing which we should strive to serve is highway traffic, we should be purveyors of transportation to his majesty, the American people. Traffic must be served!

Conclusions

I have rambled around without saying more than is worth while, than the law allowed, and I am ready to call it a day. I did not expect to prove anything definite when I started and I am not disappointed that I have not done so, even if you may be.

(Concluded on Page 8)

HIGHWAY TRANSPORTATION

Motor Truck Revolutionizes Coal Delivery System in New York City*

By LOUIS S. WEBER†

Motor trucks have practically revolutionized the coal business in New York City. In fact, without them, it would now be impossible to supply the vast quantity of coal that is consumed daily by both large and small users.

Thirty years ago there were about 300 principal retail coal dealers in New York, whle today there are about 25. This decline in number of dealers and the transformation of the business into fewer big concerns, buying and selling on a large scale, has been equally apparent in other large cities, and the reason for it lies principally in the smaller profits that prevail in the business today, together with the necessity for large plants with the most improved and efficient mechanical equipment. In addition to this there are many advantages accruing to the dealer who is located on the water front, and the economies of operation that result have practically eliminated the inland dealer. So it is no longer possible for a man to lease an empty lot, erect a few crude bins for coal, buy a few horses and carts, and start in the coal business.

The modern coal dealer in the city has big coal-pockets located on the water front, generally made of reinforced concrete as a protection against fire. His plant is equipped with the latest and best machinery for unloading the coal from barges into pockets, from which it is in turn discharged into motor trucks and delivered to the customer.

In the old days a customer who ordered 5 tons received five deliveries of 1 ton each. Today, 7 or 8 tons are hauled in a single trip, each motor truck delivering as high as 125 tons of coal a day and with delivery hours much shorter than they were in the days of horse-drawn equipment. Many large buildings consume 20, 30, 50, and even 100 tons of coal a day. With horse-drawn equipment it would be utterly impossible to deliver this amount, both because of poor unloading facilities and the slowness of team delivery.

Coal is dumped from horse-drawn vehicles by means of a crank, while with motor trucks power hoists are used. This in itself is an exceptionally big advantage since a driver can work as efficiently at the end of a day as he can at the beginning, and deliveries are not slowed down because the driver is tired.

With the large volume of business and the quick deliveries necessary, it would be simply impossible to run a coal business of any size without a motor truck. Even if it were possible to deliver coal with horse-drawn equipment, the cost would be so great that prices would have to be practically doubled. Think of delivering 125 tons of coal in a day with teams and men, hauling a ton or two at a time, as was the case in the old days, and you will realize

PART OF THE WEBER-McLAUGHLIN COMPANY'S FLEET OF MACK TRUCKS EQUIPPED WITH REAR DISCHARGE BODIES the part the motor truck is taking in our modern life and why the restrictive legislation that is being aimed at it must eventually die out.

---

*From "The Mack Bulldog."

†President, Weber-McLoughlin Company, New York City.

We have had exceptionally successful experience in our operation of motor trucks. We have a fleet of 15 Macks and 6 Sauers. Most of the Macks are 7½-tonners, since we believe that economy lies in hauling the largest loads possible. We have our own garage, keep a force of mechanics, do all our own repair work, and do not allow drivers to make mechanical adjustmnts. We have tangible proof of the advantages of this method in the good service our trucks are giving. For instance, one of our Macks recently had its first overhaul after four years' service and the cylinders, shaft and bearings were in excellent condition. A feature of Mack design that has appealed to us is the radiator at the back of the engine instead of in the front.

As far as loading is concerned, this is easily and quickly accomplished by running the trucks under the pockets from one direction and out in the opposite direction, so that it is a continuous process and the trucks do not get in the way of one another. The loaders develop remarkable skill in estimating the amount of coal in a load and sometimes the addition or removal of a shovelful is all that is necessary to give the correct weight. Where small loads of one or two tons are delivered, division boards are placed in the body of the truck, and each order is put into its compartment and weighed to get the correct weight in each case.

For unloading, we have found the rear discharge type of body to be the best for all purposes as it permits the coal to be dumped more quickly and wth less trouble. There is only one place where the side discharge is of advantage and that is in narrow alleys or delivery places where it is impossible to back a load to make a rear-end delivery.

A few horses and carts are left in our delivery system and these are used in the delivery of small loads short distances, but as they wear out, we replace them with motor trucks. Some of our Mack trucks have been in our service so long that they have been charged off on our books for several years. In cold weather, when the streets are covered with ice, the loads of horse-drawn equipment have to be reduced as much as half, and even then it is necessary to use an extra team and driver. The motor truck carries its full capacity regardless of heat or icy streets, and no extra driver is required.

The retail coal business is becoming one of volume and speed of delivery, and because of this the motor truck is the only means of transportation that fulfills the modern coal dealer's requirements.

Relative Service Value of Different Types of Rural Pavements

(Concluded from Page 6)

Summing up very briefy the meat there may be in this article we can say as follows:

1. Service value must always be considered with reference to service cost.

2. In comparing the relative service value of pavements, interest on the successive investments should be included in the gross cost.

3. Soil, climatic and rainfall conditions have a bearing on service value and should be always reckoned with.

4. Width is an important factor in service and has a very large bearing on the conduct and maintenance cost of pavements, especially of the inferior types.

5. Proper design and layouts are important, regardless of type, and poor design and layouts seriously impair the service value of the best types.

6. Traffic has a grave bearing on service and must be restricted and controlled in advance of construction plans.

7. States must probably divide their roads into classes and name the limiting load for each class. All roads cannot be made 15-ton roads every day in the year.

8. It is not always possible to build the surface that will give the most economical service on the specific portion of highway, and it is not always advisable to do so.

9. There can be no comparison of service values without assuming proper maintenance of all types of surface.

10. Constant travelability is supremely important, especially on main traveled highways, and will often determine the type and width of surface to be used.

11. In planning improvements consideration of the traffic problem is of the gravest importance. Before any extensive program is laid out, the executives who control the construction should carefully survey the traffic situation and the highway conditions in their own and the surrounding units of government and plan to meet them.

12. We should probably seek to decentralize and spread intense traffic on several roads rather than seek to put it all on one.

13. Expediency is not always wicked; it may sometimes be another name for common sense.

14. It is better to travel over an uneconomically designed but passable highway system than not to be able to get through on a theoretically perfect one.

15. The function of highways and of highway departments is to serve traffic and to furnish means of transportation.

16. Today's traffic must be served.

MEETINGS

Calendar of Coming Meetings

Jan. 6-8—Highway Engineers' Association of Missouri—Fourteenth Annual Meeting, Planters Hotel, St. Louis, Mo. Secretary, Carl W. Brown, First Assistant Engineer, Missouri State Highway Department, Jefferson City, Mo.

Jan. 19—American Society of Civil Engineers.—Annual meeting, New York, N. Y. Secretary, Charles Warren Hunt, 33 W. 39th St., New York, N. Y.

Jan. 25-27—Assocated General Contractors of America.—Annual convention, New Orleans, La., Chicago, Ill.

Feb. 9-12—American Road Builders' Association.—Eighteenth Annual Convention, Eleventh American Good Roads Congress and Twelfth Good Roads Show under the auspices of the A. R. B. A., The Coliseum, Chicago, Ill. Secretary, E. L. Powers, 11 Waverly Place, New York, N. Y.

American Road Builders' Association

Road work in 1921, for which more than $1,000,000,000 has been made available, as a partial remedy for employment conditions that exist throughout the country, will be one of the principal subjects considered at the big Good Roads Congress and National Good Roads Show to be held at the Coliseum in Chicago, Ill., Feb. 9-12, according to an announcement made at the offices of the American Road Builders' Association, under whose auspices the Congress will be held. The association is composed of federal, state, county and city highway officials, as well as engineers, contractors and manufacturers of road building machinery and materials. According to the association, a total of $540,800,000 has recently been appropriated for road work in sixteen states. In addition to this, $160,000,000 is available through federal aid and $276,200,000 has been provided through direct levies by states and counties. The work already outlined, it is believed, presages an unprecedented amount of road work throughout the United States for 1921, and the road interests, therefore, are sanguine as to the immediate future.

Among the questions to be considered at the Chicago meeting are improved methods in road building and maintenance, the need for better highways as railroad feeders, road bonds, the powers and duties of highway officials and the use of convict labor on the roads. Other topics will be those of types and foundations of roads, testing materials, labor saving machinery, storage and payment for materials as delivered, improving rural marketing conditions with better roads, financing the contractor, good roads and national defense, limitation and regulation of traffic, adapting local materials, the use of motor trucks, tractors and trailers for highway transportation and in road building. The subjects of car supply, first costs, highway legislation, elimination of contractors' risks, highway specifications, subgrade and its relation to pavement design, bridge and culverts construction, state aid and continuance of federal highway appropriations, will be presented. Invitations to attend the congress have been sent to more than 30,000 delegates.

National Conference on Highway Traffic Regulations

Temporary organization of a body to be known as the National Conference on Highway Traffic Regulations was completed at a meeting held in Cleveland, O., on Dec. 7-9, by the Executive Committee of the International Traffic Officers' Association. The new organization was formed by representatives of 15 national and 3 local associations, and will meet in Washington, D. C., on Jan. 10, to reach final agreement on traffic regulations which will be presented to 42 state legislatures for consideration.

Temporary officers were elected as follows: Chairman, Charles M. Talbert, Director of Streets and Sewers, St. Louis, Mo.; Vice Chairman, Harry Meixell, Secretary, Motor Vehicle Conference Committee; Secretary-Treasurer, D. R. Faries, of the Automobile Club of Southern California.

Transportation Committee of Federal Highway Council

The Transportation Committee of the Federal Highway Council met with representatives of various transportation interests at the Hotel Commodore, New York City, on Dec. 10 and discussed the relation of the motor truck to the transportation problems of today.

A. E. Beck, Traffic Manager of the Merchants and Manufacturers Association of Baltimore, spoke upon the store door delivery system as practiced in Baltimore. Following the address of Mr. Beck, a resolution was presented by J. C. Lincoln, Manager of the Traffic Bureau of the Merchants' Association of New York City, providing that the committee on store door delivery confer with carriers and shippers and report at the next meeting on transportation of the council.

B. F. Fitch, President of the Motor Terminal Co., Cleveland, O., spoke upon the movement of freight in that city by means of trucks equipped with demountable bodies.

Other speakers included S. M. Williams, Chairman of the Federal Highway Council; David Beecroft, of the Class Journal Co., New York City, and J. H. Collins, Manager of the Research Department, Chilton Co., Philadelphia, Pa.

The American Railway Association was represented by F. E. Williamson, General Superintendent of the New York Central, who declared the improvement of terminal conditions would eliminate many of the present transportation problems.

The American Express Co., was represented by F. S. Holbrook, Vice President and Treasurer, who stated that store door deliveries could not be handled to advantage at the present time by express companies.

Kansas Engineering Society

The annual meeting of the Kansas Engineering Society was held on Dec. 16 and the following officers were elected: President, P. F. Walker, Dean of the University of Kansas; Vice President, Lloyd B. Smith; Secretary-Treasurer, J. M. Averill.

Manitoba Good Roads Association

The annual banquet of the Manitoba Good Roads Association was held at the Royal Alexandra Hotel, Winnipeg, Man., Canada, on Nov. 19. Prizes were awarded to the winners of the annual road dragging contest and stereopticon views pertaining to road work were shown. Among the speakers were Mayor Gray of Winnipeg; T. R. Deacon of the Provincial Good Roads Board; A. McGillivray, Highway Commissioner of Manitoba; A. C. Emmett of the Manitoba Motor League.

Convention of the Delaware State Highway Department

The second annual road exhibit and convention of the Delaware State Highway Department was held in the DuPont Hotel, Wilmington, Del., on Dec. 1-4. Motion pictures showing the construction of roads were exhibited, and models of bridges and roads, together with charts setting forth traffic and other statistics, were displayed. Laboratory apparatus, including testing machines, viscosimeters, etc. were included in the exhibits.

On Friday evening, Dec. 3, state highway employees made up a theater party and on Saturday afternoon various phases of road building were discussed.

The Engineers' Club of Philadelphia, Pa., will discuss the topic, "The Development and Future of Handling Freight by Motor Trucks," at its meeting on Jan. 7.

PERSONAL MENTION

J. K. Harris was recently appointed borough engineer of Sharon, Pa.

M. A. Lynch has resigned as district engineer of the Pennsylvania State Highway Department.

John Klorer, formerly Assistant State Engineer of Louisiana, is now city engineer of New Orleans, La.

D. B. Goodsell has been appointed field engineer by the Portland Cement Association, with headquarters in Richmond, Va.

M. L. Worrell has been appointed highway engineer with the U. S. Bureau of Public Roads. Mr. Worrell was formerly in the Construction Division of the Army.

OBITUARY

John W. Wolfe, Divson Engneer of the Board of Local Improvements, Chicago, Ill., died on Dec. 12 in that city.

Owen McKay, formerly engineer for several municipalities in Canada, died in Guelph recently at the age of 72 years.

Benjamin Holt, President of the Holt Manufacturing Co., died at Stockton, Cal., on Dec. 5, following a short illness. Mr. Holt was born in Merrimac County, New Hampshire in 1849, and in 1868, he and two brothers engaged in the manufacture of wagon spokes and hubs. In 1873 a plant was established at Concord, N. H., for the manufacture of wagon wheels. Ten years later Benjamin Holt went to Stockton, Cal., where he and a third brother, C. H. Holt, started to manufacture wagon wheels. In 1892 the Holt Manufacturing Co., was incorporated in Stockton. Among the inventions of Benjamin Holt are the Holt harvester, which combines the operations of cutting, threshing and cleaning grain, a self-propelled harvester, the Holt steam traction engine, and the track-laying type of tractor bearing his name. In 1909 the Peoria, Ill. plant was established for building the Holt "Caterpillar" tractor, in conjunction with the plant at Stockton.

BENJAMIN HOLT

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CONSTRUCTION TRANSPORTATION MAINTENANCE

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Number 2

Some Considerations Governing the Design of Pavements for Heavy Traffic*

By PREVOST HUBBARD†

The load carrying capacity of any type or design of pavement must of necessity be influenced by the support afforded the pavement from below. Such support is furnished by that portion of the earth directly below the pavement known as the subgrade. The supporting value of natural subgrades varies enormously, as illustrated by the two extremes of muck or quicksand and solid rock. Most subgrades consist of soil lying between the extremes mentioned but still varying greatly in supporting value, depending not only upon type but upon their moisture content and degree of compaction. With very few exceptions any well compacted soil will of itself support the heaviest conceivable traffic if its moisture content is properly controlled and if it is protected by a structure which prevents the displacement of particles at its surface. The protective structure termed the pavement will then need to be only of sufficient thickness to afford such protection and at the same time itself withstand the various destructive agencies of traffic. For a given traffic this thickness will depend largely upon the type of pavement used.

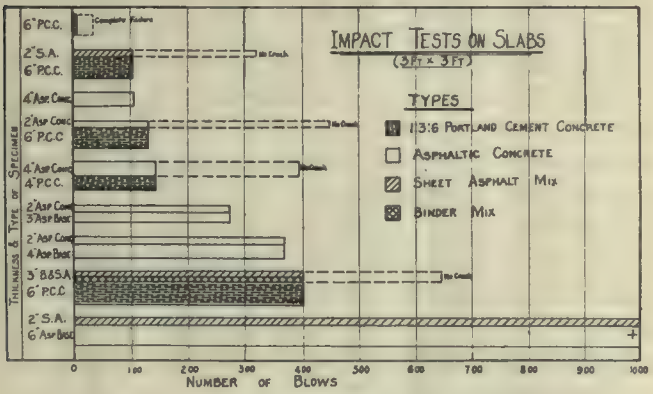

FIG. 1 IMPACT TESTS ON SLABS

The bearing capacity of most soils, particularly the clayey types, decreases as their moisture content increases above a certain point. Although there is much yet to be learned regarding the comparative bearing value of soils, this fact is generally recognized and various drainage methods are employed to control the moisture content of the subgrade. Proper drainage is the first essential for maintaining a dry subgrade and measures taken to prevent access of water to the subgrade directly below the pavement are often more important than measures designed to remove accumulations of water in the subgrade. Some soils are so persistently retentive of moisture once absorbed that it is impossible to remove it with sufficient rapidity by any ordinary system of drains. Certain clayey soils belong to this class and when all practical preventive measures in the way of drainage are apt to prove inadequate it may well be advisable to modify the character of the subgrade material. Thus, at

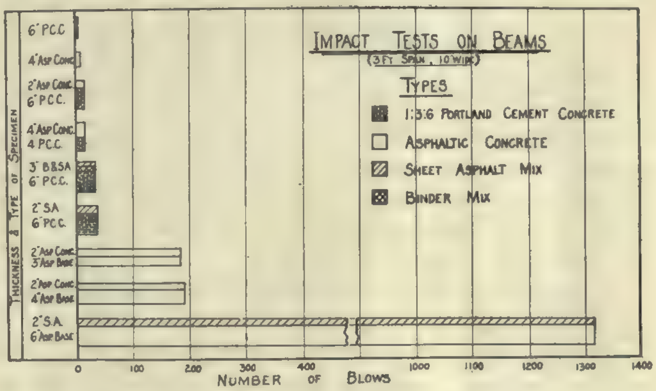

FIG. 2 IMPACT TESTS ON BEAMS

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*Paper presented before the Engineers' Club of Philadelphia, Dec. 21, 1920.

†Chemical Engineer, The Asphalt Association.

relatively low cost, a clay subgrade may often be greatly improved by mixing it with sand in exactly the same manner as in the construction of a sand-clay road. Such a mixture will not only retain less moisture than the clay, but will possess a much higher supporting value than moist clay.

It is now generally admitted that in the past too little attention has been paid to drainage in the construction of pavements outside of municipalities. At the same time there exists a marked tendency to increase the massiveness of design to a point far beyond that which is at present proving entirely satisfactory for heavy traffic in municipalities and in other places where subgrade conditions are favorable. This matter should receive the most careful consideration of engineers as it points not only to the most logical but also the most economical solution of the design of pavement. It is evident that in many cases it will cost far more to increase the thickness of a pavement to such an extent that it will distribute the load sufficiently to enable a poor subgrade to support it than it would cost to change natural subgrade conditions so as to create a high supporting value for the relatively thin pavement.

The widespread use of rigid pavements or pavements with rigid foundations has been largely responsible for this trend in paving design through too great dependence upon the bridging value of such rigid types; and right here exists a rather anomalous stuation, for while many claims are made of the bridging value of rigid pavement it is generally admitted that careful preparation of the subgrade is necessary to uniformly support these rigid types. As a matter of fact, no practicable design of highway for modern heavy traffic permits the assumption of more than a temporary bridging action over appreciable areas of a weak subgrade.

In pursuing a policy upon which general attention has once been centered, many who are interested in highway construction are apt to overlook the experience of others following different lines of development and fail to profit by their experience. One of the most striking examples of this has to do with the flexible type of construction as represented by the asphalt base pavement and this in spite of a number of valuable papers and discussions upon the subject by leading engineers. Citations of past and present experience in localities other than that of interest to the individual engineer apparently carry little weight once the majority concentrates on a given line of development, and it is difficult to focus attention on any other line for the time being. To state that considerably over 12,000,000 sq. yd. of asphalt base pavement are now giving satisfactory service in California and Oregon, many of them 5 in. or less in total thickness and subjected to heavy motor truck traffic, and that some of these pavements have been in service for over 20 years with little or no cost for maintenance should at least arouse some degree of interest on the part of eastern engineers. To further state that in such cities as Washington, D. C., Chicago, Omaha, Pittsburgh, Buffalo and Denver, there are in existence sections of bituminous base which have given satisfactory service for over 20 years should also serve to dispel any illusion that the serviceability of this type is restricted to any given locality. Service results should in themselves be conclusive, but explanations of such results are sometimes required before their full significance is grasped. It is true that theories have been advanced but these have not been backed up by test data in such a way as to make them convincing. Some degree of cushioning effect under traffic has been claimed and admitted for the asphalt base as well as the wearing course, but few engineers have believed that a mineral aggregate cemented together with asphalt could possibly possess any degree of slab strength or beam strength at least to an extent comparable with the rigid type of construction.

With this in mind an investigation was begun under the direction of the writer, assisted by W. E. Rosengarten, Traffic Engineer of the Asphalt Association, to determine certain relations that exist between the rigid and flexible types of construction. Fortunately, through the very valuable work of the U. S. Bureau of Public Roads, it has already been proven that impact and not dead load is the most destructive traffic factor to be taken into account in the design of modern highways. It was, therefore, decided to limit these investigations to a study of the effect of impact upon test specimens having thicknesses equivalent to those commonly used in the construction of highways. It was clearly realized in advance that it would be impossible to duplicate all of the variable conditions under which impact is delivered to a pavement by traffic and it was, therefore, decided to confine this study to the effect of pure impact as delivered by an iron ball falling from a relatively small height.

The following description of tests will be brief, both because of the limited time available for the presentation of this paper and because the results here reported are only a portion of those included in a more comprehensive investigation involving other comparisons, which will shortly be presented in a detailed article.

In order to obtain comparisons at two extremes of conditions it was decided to construct and test slabs of various design upon a solid uniform subgrade and to test beams of the same design supported only by knife edges. A plot of ground was secured and upon this was laid a 6-in. course of cinders thoroughly compacted by rolling. Slabs, 3 ft. square, were constructed directly upon this subgrade except that after the forms had been placed the subgrade within the forms was leveled up with a very thin layer of sand so that each specimen would have a uniform thickness throughout. Portland cement concrete slabs were cast 4 and 6 in. thick of a 1:3:6 mix. These were cured under a cover of moist sand after they had set. Some of the concrete slabs were then covered with from 2 to 4 in. of coarse graded aggregate asphaltic concrete and some with sheet asphalt, with and without a binder course. In addition, slabs were constructed of asphaltic concrete base mixture and covered with either asphaltic concrete surface mixture or with sheet asphalt so as to produce total thicknesses directly comparable with the Portland cement concrete base specimens. At the same time corresponding sets of beams, 4 ft. long and 10 in. wide, were constructed of the same type and thickness. In general the specimens were tested when the concrete was 28 days old, although in a few cases they were slightly older when for one reason or another it was found impossible to keep up with the testing schedule which had been planned.

All slabs were tested where they had been cast, by means of a machine which was designed and operated so as to drop a 125-lb. iron ball upon the center of the upper surface from a height of 6 in. at the rate of about 30 blows per minute. In all cases a specimen was considered to have failed when the first crack appeared. Cracks in the Portland cement concrete were invariably first noted developing on one or more sides of the specimen from the plane of contact with the subgrade. Under continued impact these cracks traveled to the upper surface of the monolith and then across the upper surface toward the center. The all Portland cement concrete specimens broke into two or four large fragments shortly after the first crack appeared, while similar slabs with an asphalt top showed no cracking of the top after the base had failed. The results obtained on check specimens were in some cases erratic; in others quite close together. By averaging results, however, the general trend is apparent and is closely borne out by results obtained on the beam specimens.

One of the accompanying diagrams (Fig. 1) shows the resistances to impact of the various types of slabs as measured by the number of blows required to produce failures. The dotted extensions of the asphalt tops on slabs with a Portland cement concrete base show the number of blows at which the test was stopped, no failure of the top then being apparent.

The beams were tested upon steel knife edges 3 ft. apart with the same machine used for testing the slabs but with a 50-lb. iron ball dropped from a height of 1½ in. at the center of the span at the rate of about 50 blows per minute. The number of blows required to produce the first crack was recorded as point of failure. In all beam tests complete failure occurred within a very few blows after a crack appeared. The results of these tests are shown in the second diagram (Fig. 2) in the same manner as the slab tests.

In considering these diagrams no attempt will be made to draw conclusions based upon a comparison of absolute values as here shown. In fact, it is frankly admitted that such a course would be unwise until much more test data are available. It is believed however that the general similarity in trend of the results obtained in both the slab and beam tests is highly significant and points to interesting facts. What is clearly apparent, for conditions under which these specimens were tested, may be summed up as follows:

Asphaltic mixtures develop very decided slab and beam strength, as measured by their resistance to impact. The all asphalt type of slab and beam appears to offer considerably more resistance to impact than an equivalent thickness of 1:3:6 Portland cement concrete, considered either as an integral structure or as a base for an asphaltic top.

It is recognized that unsupported by practical service results, deductions drawn from these tests might not be conclusive as applied to the design of highways for heavy traffic. They do, however, help to explain the remarkably satisfactory service record of the millions of square yards of 4 and 5-in. asphaltic concrete pavements in California and Oregon and point the way to a more rational development in the design of highways in other localities. In summing up the substance of this paper there are a few points which the writer wishes to emphasize:

1. Any rational design of highway should take into account the fact that the subgrade must ultimately take the weight and shock of traffic as transmitted through the pavement and practically any reasonably dry subgrade will do this if it is compacted and its surface is protected from displacement. Careful attention to subgrade preparation and drainage is, therefore, the first essential to be considered.

2. The asphaltic concrete pavement is highly resistant to impact which is recognized as the most destructive traffic factor; and under impact, develops as a single unit relatively high slab and beam strength.

3. It is manifestly uneconomical, if not impracticable, to adopt a design of highway which will permanently bridge appreciable areas of weak subgrade. While the asphalt type develops bridging action to an appreciable extent it will of itself constantly seek to maintain contact with the subgrade at all points and thus reinforce itself with the maximum supporting value of the subgrade. The rigid type of pavement or base cannot do this because of its inherent characteristics. It is, therefore, almost sure to crack eventually where appreciable areas of subgrade fail to support it uniformly.

4. Both the service history of asphalt base pavements and the test data here presented indicate that under given conditions it is not necessary to adopt as massive a design for the flexible type of base as for the rigid type. It is difficult for engineers who have had no opportunity to observe the asphalt base pavement under heavy traffic to think of it in terms of less thickness than the rigid base, but in the light of present experience such consideration appears to be entirely warranted.

———ooo———

Traffic Counts in Various States—I*

Brief Descriptions of the Progress Made in Traffic Censuses in the Several States—Classifications Adopted — Results

By A. N. JOHNSON†

The following summaries of traffic enumerations that have been made in the various states as noted were compiled from information recently furnished the writer by the various state highway departments. Special mention has been made of the classification of traffic that has been used in the different states as well as the duration and frequency of the counts.

For the present purpose it was not thought necessary to give any detailed results of the various enumerations, though in some instances certan general conclusions that had been made have been mentioned.

Acknowledgement is gratefully made to the state engineers who have so generously placed at the writer's command such complete information upon very short notice.

Alabama

No traffic counts have been taken by the State Highway Department except on sections of roads that were to be put under construction, the census being used as a basis to estimate the annual tonnage to be carried by the road in question.

The report states, however, that Jefferson County, in which is located Birmingham, undertook a traffic census as part of the plan made for a $5,000,000 bond issue. Traffic was observed on practically all of the roads of the county for two days each week for three consecutive months, the observers being stationed at the intersections of two or more roads.

The observers were furnished with blank forms divided into hourly periods. The traffic was classified as follows:

Large trucks; small trucks; 5 or 7-passenger cars; 2 passenger cars; 2-horse wagons, single-horse wagons; buggies; motorcycles or bicycles; miscellaneous.

Trucks were noted as being loaded or empty. The average speed was also noted.

The count was made for 14 hours a day. The observers were first stationed approximately 5 mi. from the city limits and each week were moved 5 mi. further out on the same road. The census was used to study the classes of traffic traveling the roads, to estimate the importance of various roads, and to determine the class of material best adapted for given situations.

The result of the traffic census showed that 80% of the traffic of the county was carried on 20% of the roads, and that 75% of the traffic was motor-driven; also that 75% of the traffic did not pass beyond the 15 mi. zone from the center of Birmingham.

Arkansas

It was reported that no traffic counts had been made.

California

No traffic census has been undertaken by the State Highway Department. During 1920 traffic counts extending over a single day were made by the United States Bureau of Public Roads at stations scattered over the state highway system, but the results of this census are not yet available.

Colorado

Traffic counts were made in 1917 and 1918 daily during August, from 6 a. m. to 8 p. m., covering many of the state highways. This work was done in cooperation with the county commissioners.

The observation stations were located close to large centers but outside of the zone of local traffic.

The classification of vehicles on the tally sheets was as follows:

Automobiles: Colorado cars; foreign cars; motor trucks; motorcycles; tractors and other engines.

Horse-drawn vehicles: 1 horse; 2-horse; 3-horse; 4-horse.

A column was included for live stock (horses, cattle and sheep). The amount of traffic each hour was recorded.

A very instructive description of the results obtained in Colorado was given by J. E. Maloney, Chief Engineer of the State Highway Department, in the

(Continued on Page 16)

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*From a paper entitled "Traffic Census" presented at the sixth annual convention of the American Association of State Highway Officials, Washington, D. C., Dec. 13-16, 1920.

†Dean, College of Engineering, University of Maryland.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

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RIGID VS. NON-RIGID FOUNDATIONS FOR HEAVY TRAFFIC PAVEMENTS

The non-rigid type of pavement foundation appears to be growing in favor with highway engineers, though the rigid type by no means lacks advocates. A particularly strong plea for the former is made in a paper that was presented recently before the Engineers' Club of Philadelphia by Prevost Hubbard, formerly of the U. S. Bureau of Public Roads and now the chemical engineer of the Asphalt Association. The paper is printed in full on other pages of this issue.

Mr. Hubbard calls attention to the fact that the load carrying capacity of any pavement is influenced by the support furnished by the subgrade and that this supporting power varies through an extremely wide range. He also points out the possibility and desirability of increasing that supporting power by proper drainage, and contends that too little attention has been paid to this phase of construction, especially outside of municipalities and that there has been a "marked tendency to increase the massiveness of design to a point far beyond that which is at present proving entirely satisfactory for heavy traffic in municipalities and other places where subgrade conditions are favorable." This tendency, he holds, is largely due to the widespread use of rigid pavements or pavements with rigid foundations and the practice in that method of construction of placing too great dependence upon the bridging action of those types. This creates a rather anomalous situation, he points out, because "while many claims are made of the bridging value of rigid pavement, it is generally admitted that careful preparation of the subgrade is necessary to uniformly support these rigid types." Continuing, he asserts that, in fact, "no practicable design of highway for modern heavy traffic permits the assumption of more than a temporary bridging action over appreciable areas of a weak subgrade."

This last statement can hardly be disputed, it would seem, nor can exception be taken to his statement that "impact and not dead load is the most destructive traffic factor to be taken into account in the design of modern highways"—proof of which he credits to the experimental work carried out by the U. S. Bureau of Public Roads.

Results obtained in service should be conclusive in themselves, but explanations of them are sometimes required before their full significance is realized, according to Mr. Hubbard. For this reason it was decided to undertake an investigation of certain relations between rigid and flexible types of foundations, despite the existence of millions of square yards of asphaltic base pavement that have given satisfactory service through long periods.

These experiments were begun under Mr. Hubbard's direction, their scope being limited to a study of the effects of impact upon specimens of thicknesses equal to those commonly used in pavement construction. The methods used and the results obtained are fully discussed in Mr. Hubbard's paper. Two diagrams prepared from the results of the tests are presented and while Mr. Hubbard says that it is "frankly admitted" that it would be unwise to draw conclusions based upon a comparison of the absolute values shown, he contends that it is clearly apparent, "for the conditions under which these specimens were tested," that:

"Asphaltic mixtures develop very decided slab and beam strength, as measured by their resistance to impact. The all asphalt type of slab and beam appears to offer considerably more resistance to impact than an equivalent thickness of 1:3:6 Portland cement concrete, considered either as an integral structure or as a base for an asphaltic top."

In ending the paper, Mr. Hubbard summarizes its substance in four paragraphs that may be regarded as conclusions. Very briefly expressed these are as follows:

The subgrade should be carefully prepared and properly drained in order to withstand the weight and shock of traffic.

The asphaltic concrete pavement is highly resistant to impact and, as a single unit, develops relatively great beam and slab strength.

It is uneconomical, if not impracticable, to design for permanently bridging appreciable areas of weak subgrade. Though the asphaltic type develops considerable such action, it seeks to maintain contact with the subgrade and thus reinforce itself with the maximum supporting value of the subgrade. The rigid type cannot do this and, therefore, will crack if unsupported.

Both service and laboratory tests indicate that it is unnecessary to adopt as massive design for flexible bases as for rigid ones.

Traffic Counts in Various States—I

(Continued from Page 14)

Colorado Highway Bulletin for October and December, 1918, and January, 1919. A map of the state highways is shown with total tonnage carried by each.

Connecticut

Traffic counts extending over three days during August for the full 24-hour period were taken at the bridge over the Housatonic River between the towns of Milford and Stratford.

The enumeration was made with the aid of counting machines, the only classification being that between pleasure vehicles and trucks.

Delaware

Soon after the organization of the State Highway Department in 1917, a traffic census was taken at 26 points to determine at that time which roads were carrying the greatest amount of traffic. No general traffic census has been taken since then, but counts have been made at certain points to compare with the results obtained by the original census. The traffic counts extended over a period of two months at intervals of eight days from 7 a. m. to midnight.

A comparison of the traffic for 1920 with the records of 1917 shows that in 1920 there has been an increase of 72% in the number of vehicles and 34% in tonnage, it being noted that the increase in the traffic coincides with the motor registration for the same period.

For purposes of classification the traffic was divided as follows:

Horse-drawn Vehicles

1-horse passenger vehicles	0.35	tons
2-horse passenger vehicles	0.50	"
1-horse freight vehicles	1.00	"
2-horse freight vehicles	2.50	"
3 or more horse freight	33.50	"

Automobiles

Motorcycles	0.225	tons
Roadsters	1.000	"
Light touring cars	1.125	"
Heavy touring cars	2.250	"
Light motor trucks	2.250	"
Heavy motor trucks	7.500	"

The average weights were used to reduce traffic to a tonnage basis.

Florida

Except in a few isolated cases no traffic counts have been made.

Georgia

Except in a few isolated cases no traffic counts have been made.

Idaho

Three traffic counts have been taken during 1920, one in March, one in June and one in September. The observation stations were located on the state highways, chiefly at important intersections. No compilation of the results has been published.

The classifications divide the vehicles as follows:

One-horse passenger; 1-horse freight; 2-horse passenger; 2-horse freight;—horse passenger;—horse freight; roadsters; touring cars; motor trucks; motorcycles; tractors; bicycles; farm machinery; saddle horses; pedestrians; loaded freight; number of passengers.

The traffic was also classified as: Farm-town; interurban; inter-county; inter-state.

Traffic counts were taken from 7 a. m. to 9 p. m. for nine consecutive days. It was expected that observers would be obliged to stop vehicles in order to get the information necessary to classify them.

Illinois

During 1906 the State Highway Department began a traffic census which extended continuously over a period of two years. There were first established 37 traffic stations at different points on the main roads throughout the state, which number was soon increased to 71. The counts were taken on an average of four days a month, no two successive counts being on the same day of the week. The record of traffic showed the total number of vehicles moving in either direction at a given point hourly from 6 a. m to 6 p. m. The vehicles were classified as loaded and unloaded. Horse-drawn traffic was indicated by the observer showing the number of horses. Motor traffic, of which there was a very small amount, was indicated by the letter A, thus giving the total number of motor vehicles.

The observations were made by people residing near the roads, the counts usually being taken by some woman of the family. It is interesting to note that at some of the stations, for the entire two-year, period no automobiles were recorded.

Traffic counts were made during 1910, 1911 and 1912 at many of the stations established in 1906 and 1907. Full details regarding this traffic census are found in the reports of the Illinois Highway Commission for 1906, p. 22, for 1907, p. 23, and the report of 1910-1912, p. 269.

As the majority of the stations selected are now located upon the new state highway system, much interest will attach to these older records in comparison to those that will be taken on completion of the state highways.

Indiana

No traffic counts have been undertaken in Indiana.

(To be Continued)

Governor Cox of Ohio Urges Reduction in Estimates on Road Work

Recommendation that the estimated costs for road building be diminished 20% after Jan. 1, was made to the State Highway Department by Governor Cox of Ohio. The costs of material and labor, the governor pointed out, have declined sufficiently to justify such action.

New Jersey Apportions Motor Vehicle Funds

The New Jersey State Highway Commission has apportioned $2,000,000 of motor vehicle funds to the various counties of the state for the maintenance of roads in 1921. The estimated total of motor vehicle fees is $3,200,000, of which amount $1,200,000 will be reserved for the repair of state roads.

California State Highway Finance Board Organized

In accordance with the provisions of the ninth amendment to the constitution of California, ratified by the voters of the state at the last election, a state highway finance board has been organized, with Governor Stephens as chairman, State Treasurer F. W. Richardson as vice chairman, and State Highway Commissioner N. D. Darlington as secretary.

Highway Work in Oregon

In the biennial report of the Oregon State Highway Department it is recommended that the activities of the department in 1921 be confined to the improvement of roads already embraced in the present system of state highways. The report shows that the state system of highways includes 20 routes with a total mileage of 2,976 mi., exclusive of sections included in cities and towns. Of this total, 1,944 mi. are improved.

It is also recommended that plans and specifications for bridges and culverts built on the state system of highways by counties, be first approved by the commission. The supervision of the maintenance of primary highways by the commission and the consolidation of the motor vehicle revenue and state highway funds, are advised as desirable by the report.

Road Work in Woodbury County, Iowa

The Woodbury County, Iowa, Board of Supervisors has awarded contracts for the construction of 17 mi. of road at an estimated cost of $700,000. About a year ago bids were asked on this work, but no bids were received. At the recent letting three bids were received.

Paving Program of Baltimore, Maryland

Plans have been approved by the Paving Commission of Baltimore, Md., for the paving of 6 mi. of streets as the first step in the city's $2,000,000 paving program for 1921. The commission also approved the appointment of Martin L. Heisse as assistant civil engineer and indorsed the plan to put Nathan L. Smith, Chief Engineer of the Commission for Opening Streets, in charge of work for the Paving Commission, which will take over the work of the Commission for Opening Streets.

Indiana Farmers Ask Repeal of Road Law

The Blackford County, Indiana, Farmers' Association on Dec. 11 passed a resolution calling upon the Legslature, at its next session, to repeal the State Highway Commission Law. The farmers feel that the benefits derived from the present law are not commensurate with the benefits that could be derived if the money were placed in the county road repair fund. The resolution also asks the abolishment of the office of county road superintendent, stating that the duties of this office could be taken over by the county commissioners.

Governor Sproul of Pennsylvania On Good Roads

Roads Essential to Agricultural Growth and Main Roads Must Be Built by States

"Good roads are no longer considered a luxury," said Governor Sproul of Pennsylvania at a recent governors' conference, "but are now known to be a necessity for the proper development of the country, and especially in the distribution of food supplies and in the encouragement of agriculture, by making country life more attractive and remunerative to our people. No development of transportation or utility in all recorded history has progressed at such a rapid rate as the adaptation of the motor car to public convenience. Great as has been the increase in the use of automobiles, the business is yet in its infancy and its strictly utilitarian phases have hardly begun to be realized.

"Local communities cannot be expected to build and maintain the main trunk lines in our highway system. This is and will continue to be a function of the states with such assistance as the National

Government may be able to give. State loans and state revenues will be drawn upon more and more heavily as the development of our highway system continues, and those commonwealths which do not realize this situation and which lag in their duty to our own people and to national progress, will suffer in the competition with their more enterprising neighbors."

Road Work in Kosciusko County, Indiana

Contracts for the construction of 35 mi. of road at a cost totaling $1,031,984 were recently awarded by Kosciusko County, Indiana. These contracts cover 13 sections of road and 30 mi. of the mileage will be of concrete. Bids were submitted by eleven contractors and more than 100 contractors and others interested were present at the letting.

Road Plans of Essex County, New Jersey

The budget of Essex County, New Jersey, for 1921 which has been prepared recently calls for an expenditure of $345,000 for road work. An additional $25,000 is asked for snow removal and $60,000 for the maintenance of bridges and culverts.

The chief items included in the estimate are, patrol system, $70,000; repairs to bituminous roads, $10,000; resurfacing 8 mi. of macadam road with bituminous material, $240,000; machinery, $15,000.

Indiana Will Buy $1,400,000 Worth of Cement

The Indiana State Highway Department has begun negotiations for the purchase of approximately $1,400,000 worth of cement to be used in road and bridge work next year. It is expected that the contracts for cement will be closed late in January.

L. H. Wright, Director of the State Highway Department, estimates that the state will require about 700,000 bbl. of cement and that a saving of 20 ct. per barrel can be made by buying the cement directly from the manufacturer and supplying the contractors. Until recently, it is stated, the manufacturers of Portland cement have protected the local distributors in prices and sales in their territories.

Oregon Supreme Court Holds County Bond Issues Valid

The Oregon Supreme Court on Dec. 14 reversed its previous ruling and declared valid bond issues of six counties passed in 1919.

An amendment to the state constitution was passed in 1919, raising the bonded indebtedness limit from 2 to 4% and it was previously held by the Supreme Court that the bond issues were passed before this law became operative and that the counties exceeded their debt limit.

The recent ruling holds, however, that the amendment of 1919 is self executing and that there is no need for further legislation to put the law into operation. More than $5,000,000 of road bonds are affected by this decision.

Bridge Built at White Salmon, Washington

An iron bridge costing $36,000 has been built at the mouth of the White Salmon River, White Salmon, Wash., forming a link in the Evergreen Highway.

Entire Staff of Nova Scotia Highways Board Dismissed

The Provincial Government has notified the entire staff of the Nova Scotia Provincial Highways Board that their services will not be required after Jan. 31. On Dec. 10, J. W. Roland, Chief Engineer and F. M. Clark, Assistant to Mr. Roland, were dismissed. This action of the Provincial Government affects nearly 100 office and field employees, and follows an investigation of the board by a royal commission.

The investigating commission reported that although only $211,000 had been estimated for work on the St. Margaret's Bay Road, contractors' claims amount to more than $600,000. It is further alleged that unauthorized expenditures have been made in every department of the board.

W. G. Clarke, Chairman of the board, has resigned and A. S. McMillan has been appointed in his place.

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The New Jersey State Highway Department will purchase 52 snowplows shortly.

The Vote in West Virginia for the good roads amendment to the constitution was about 10 to 1 in favor of the bonds, according to a recent press report.

The Federal Highway Council, at its recent meeting at Akron, O., resolved to raise a budget of $50,000 to place before the American public the message of good roads.

Traveling over California's Highways in a wheel chair, B. E. Davis, of Los Angeles, recently made a trip to San Francisco and return, making the return trip in 30 days.

The Wisconsin Legislature last year passed a law requiring all municipal motor vehicles, including fire and police vehicles, to be registered, with payment of the regular fee.

MEETINGS

Calendar of Coming Meetings

Jan. 19—American Society of Civil Engineers.—Annual meeting, New York, N. Y. Secretary, Charles Warren Hunt, 33 W. 39th St., New York, N. Y.

Jan. 25-27—Associated General Contractors of America.—Annual convention, New Orleans, La., Chicago, Ill.

Feb. 9-12—American Road Builders' Association.—Eighteenth Annual Convention, Eleventh American Good Roads Congress and Twelfth Good Roads Show under the auspices of the A. R. B. A., The Coliseum, Chicago, Ill. Secretary, E. L. Powers, 11 Waverly Place, New York, N. Y.

Virginia Good Roads Association

The annual meeting of the Virginia Good Roads Association will be held in the Hotel Roanoke, Roanoke, Va., on Jan. 26, 27 and 28. Highway problems in Virginia and the opportunity for greater road development in the state as a result of the adoption of the good roads amendment to the state constitution, will form the principal topics of discussion.

Among the speakers will be, D. D. Hull, Jr., President of the Lee Highway Association; James W. Brooks, Director of the Educational Bureau of the Federal Highway Council; Wade H. Massie, Chairman of the Virginia State Highway Commission; George P. Coleman, State Highway Commissioner of Virginia, and C. C. Vaughn, Jr., President of the Virginia Good Roads Association.

Seventh Annual Road School of Purdue University

The seventh annual road school of Purdue University, cooperating with the Indiana County Highway Superintendents' Association and the Indiana State Highway Commission, will be held in the civil engineering building of the university at Lafayette, Ind., on Jan. 18, 19 and 20. Dean Potter and Prof. Hatt will give addresses of welcome and responses will be made by D. C. Sheetz, President of the Indiana County Highway Superintendents' Association, and Archy Campbell, Chairman, Indiana State Highway Commission.

In the afternoon of Jan. 18, the following papers and addresses will be given: "An Efficient Organization for Maintenance," A. H. Hinkle, Chief Engineer of Maintenance, Indiana State Highway Department; "Maintenance of Earth Roads," Prof. C. C. Albright; "Maintenance of Gravel Roads," C. J. Ulery, Highway Superintendent, Elkhart County; "Maintenance of Concrete Roads," W. G. Tonkle, Highway Superintendent, Allen County; "Maintenance of Brick Roads," speaker to be announced; "What I Saw on Indiana Roads," Ben H. Petty, Instructor in Highway Engineering.

In the evening of Jan. 18 the following papers will be given: "Indiana State Road System," L. H. Wright, Director, Indiana State Highway Department; "The County Road Superintendents' Records and the State Board of Accounts," L. F. Orr, Indiana State Board of Accounts; "Relation of County Roads to State Roads," S. B. Mylin, Highway Superintendent, Wabash County.

On the morning of the second day papers will be presented on: "Maintenance of Macadam Roads," W. O. Jones, Highway Superintendent, Wayne County; "Use of Cold Mix as a Maintenance Material," H. M. McCaskey, Highway Superintendent, Grant County; "Maintenance of Bituminous Roads," G. E. Martin, formerly Associate Professor of Highway Engineering at Purdue University; "Specifications for Road Materials," Fred Kellam, Chief, Bureau of Tests, Indiana State Highway Department; "Testing of Road Materials," R. B. Crepps, Instructor, Purdue Testing Laboratory.

The afternoon session of the second day will be devoted to the following: "Some Problems of the Highway Engineer," D. Moomaw, Highway Engineer, St. Joseph County; "Inspection of State Construction from the Contractor's Standpoint," W. P. Carmichael, Attica; "Compensation for Inspectors on County Road Construction," J. G. Hays, County Commissioner, Marion County; "Relation of the Federal Bureau of Roads to the State," T. H. MacDonald, Chief, U. S. Bureau of Public Roads; "Highway Economics," A. R. Losh, U. S. Bureau of Public Roads.

The annual banquet will be held on Wednesday evening, Jan. 19 and addresses will be given by Warren T. McCray, Governor-elect of Indiana, and W. E. Stone, President, Purdue University. Following the banquet, the annual meeting of the Indiana County Highway Superintendents' Association will be held.

The final session, to be held in the electrical building on Thursday morning, Jan. 20, will embrace the following: "Machinery for Maintenance" (motion pictures), V. E. Trimble, of the J. D. Adams Co.; "Care of Machinery and Motor Equipment," Jack Holloway, Purdue University; "Machinery for Road Construction" (motion pictures), K. N. Talbot of the Koehring Machine Co.; "Highway Transportation," speaker to be announced.

New Jersey State Association of County Engineers

The annual meeting of the New Jersey State Association of County Engineers will be held in Trenton on Jan. 25 at the Engineers' Club. In the morning the business meeting with the election of officers and reports of committees, will be held. In the afternoon three papers will be presented, as follows: "Bridges for New Jersey Roads," by Charles A. Meade, Bridge Engineer, New Jersey State Highway Department; "Some Facts Relating to Motor Vehicle Registration," by W. L. Dill, State Commissioner of Motor Vehicles; "Testing and Laboratory Control of Large Highway Contracts," by R. B. Gage, State Chemist.

PERSONAL MENTION

H. F. Koch has resigned as city engineer of Denton, Tex.

F. C. Wyse has resigned as city engineer of Columbia, S. C.

C. S. Sloan has been appointed city engineer of Manteca, Cal.

A. M. Evans has resigned as city engineer of Norwich, N. Y.

W. S. Tomilinson has been appointed city engineer of Columbia, S. C.

E. R. Davis has been appointed city engineer of Newport News, Va.

William M. Irvin has been appointed county engineer of Jefferson County, Kansas.

G. G. Tyrrell has been appointed resident engineer on federal aid work in Mississippi.

B. Woodyard recently resigned as highway engineer of Wood County, West Virginia.

F. A. Tokelson has resigned as county road engineer of Chippewa County, Michigan.

Craig Arnold has been appointed an engineer of the Georgia State Highway Department.

S. R. Batson recently resigned hs position of highway engineer for Jefferson County, Alabama.

A. G. Brusewitz has resigned as county highway commissioner of Outagamie County, Wisconsin.

Frederick W. Palmer, Assistant to the First Deputy Commissioner, New York State Highway Department, has resigned.

J. G. Rollins has resigned as county engineer of Webb County, Texas, and is now with the Nagle, Witt, Rollins Engineering Co.

A. I. Heim, formerly with the Montana State Highway Department, is now office engineer with the Foote Engineering Co., Meridan, Miss.

C. E. Stahl, formerly Highway Engineer of Renville County, Minnesota, has been appointed locating engineer by the Minnesota State Highway Department.

G. A. Bracher has been appointed county engineer of Washington County, Texas, resigning his position as highway engineer with the U. S. Bureau of Public Roads.

H. D. Phillips, formerly with the Massachusetts Department of Public Works, Bureau of Highways, has been appointed engineer for District No. 2 by the Connecticut State Highway Department.

Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport at the University of Michigan, has been appointed consulting engineer on paving work to be done in Colorado Springs, Colo., which will cost about $1,000,000.

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Fond du Lac County, Wisconsin, will spend over $1,000,000 on highway improvement in 1920.

The Wisconsin State Highway Department recently destroyed a colony of beavers, which interfered with the construction of a road through the Bibon Marsh, near Washburn.

The County Commissioners of Allegheny County, Pennsylvania, recently authorized a county road bond issue of $1,250,000.

The Board of Trade of Lansdale, Pa., recently celebrated the completion of a new highway at that place. An automobile parade was held in the afternoon and in the evening a banquet was spread for 200 guests.

Marathon County, Wisconsin, will spend $255,000 next year in improving two sections of the state hghway system in the county. Fourteen miles on highway No. 13 will be graded and surfaced with gravel and 5.5 mi. will be similarly improved on highway No. 10.

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GOOD ROADS

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THE IDEAL DUST PREVENTIVE
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SUMMIT, N. J.

Concrete Roads must be reinforced

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Fulfills Every Engineering Requirement.

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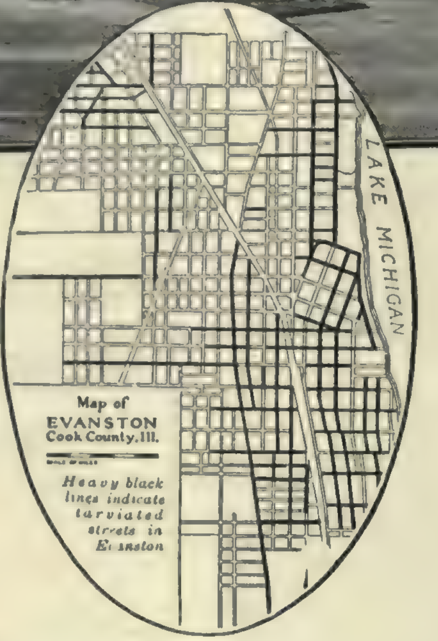
NOW COMES THE PROBLEM OF MAKING OUR INTER CITY HIGHWAYS MEET THE REQUIREMENTS OF HEAVY TRUCK DUTY

GRANITE PAVING BLOCK
MANUFACTURERS' ASSOCIATION
OF THE UNITED STATES, INC.
JAMES J. TOBIN, Field Engineer
31 STATE STREET BOSTON, MASS.

The "Evanston Plan" of Street Maintenance

Orrington Ave., Evanston, Ill. Old waterbound macadam surfaced with "Tarvia-A" June, 1919.

Sheridan Road, Evanston, Ill. One of the Improvement Association Streets, constructed with "Tarvia-A" in 1915-1916.



Map of EVANSTON Cook County, Ill.

Heavy black lines indicate tarviated streets in Evanston

WITH natural pride in their beautiful city, which lies just north of Chicago, the property owners and city authorities of Evanston, Ill., have worked out what has come to be known as the "Evanston Plan" for keeping their macadam streets in first-class condition.

The property owners on many streets have local Improvement Associations, who voluntarily contribute to the cost of maintenance of their street. This fund was formerly used for street sprinkling, but is now being used in systematic Tarvia maintenance. The work is handled by the street department under the direction of the Commissioner of Streets. This has worked out so satisfactorily that some of the Associations have a surplus in their treasury, where formerly all the funds went into street sprinkling, and the streets are dustproof, waterproof and automobile proof.

Keeping Ahead of Old General Neglect

The policy of the City of Evanston is to repair and re-treat the streets *before it is absolutely necessary.* Three patrol gangs are kept on the streets all summer, immediately patching any spot in the macadam that begins to show signs of wear. As a result, the entire system of more than a half million square yards of Tarvia-treated macadam pavement is kept in wonderful condition all the year round.

In fact, the streets of Evanston form a striking testimonial to the efficiency of systematic Tarvia treatment and low cost maintenance.

The Efficiency of Barrett Service

The present Commissioner of Streets, Mr. R. M. Brown, writes as follows:

> "Efficiency of service by your company in the delivery and application of Tarvia to the City of Evanston during the past season has been very satisfactory.
>
> I assure you that your efforts in our behalf are appreciated, as we are able to keep our pavements in good serviceable condition despite the fact that they are subjected to unusually heavy traffic."

Property Owners Prefer Tarvia

Former Commissioner of Streets Mr. Walter W. Krafts, before leaving office, wrote as follows:

> "The people of Evanston are satisfied in every respect, and in asking for work to be done on streets, are asking for Tarvia in preference to other binders."

The Evanston plan of street maintenance is attracting a great deal of attention in other municipalities.

We should be very glad to explain this plan in greater detail to any interested city official or property owner upon request. In writing, address the nearest Barrett Company office.

Tarvia

Preserves Roads–Prevents Dust

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by any one interested. If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will be given prompt attention.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Old Series, Vol. LX
New Series, Vol. XXI
JAMESTOWN, N. Y., JANUARY 19, 1921
Number 3

The Georgetown Bridge Over the Potomac

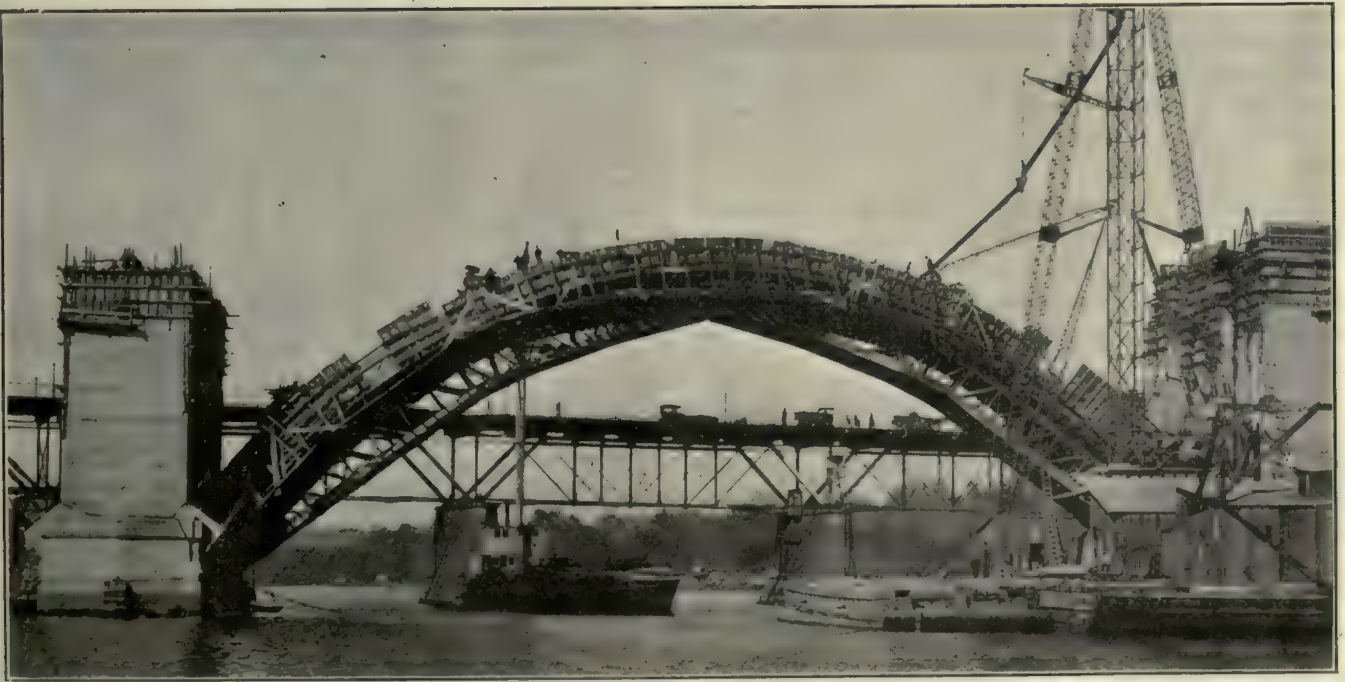
Steel Arch Forms for Ribs Are Floated Into Place by Tide and Fall in Place at Its Ebb — Central Arch 208 Ft. Long

A large reinforced concrete highway bridge is now in course of construction over the Potomac between Georgetown, District of Columbia, and Rosslyn, Va., to take the place of the old Aqueduct Bridge at that point. Congress has approprieted $2,000,000 to build the bridge and the work is being carried on by the Engineer Corps of the United States Army. Major M. C. Tyler, Corps of Engineers, is in charge of the construction.

The old Aqueduct Bridge was built in 1832 and originally carried a roadway and the Chesapeake and Ohio Canal over the Potomac. In 1888 the wooden aqueduct was taken out, being supplanted by an iron deck truss. Because of the instability of the pier foundations, considerable trouble has been experienced in maintaining the structure, and the advisability of replacing the brdge by a modern structure capable of meetng the demands of modern traffic, was under discussion for a number of years.

The total length of the structure will be 2,700 ft. of which 1,500 ft. will be approaches. The bridge will be 70 ft. wde, carrying two electric railway tracks, two 16-ft. roadways and two sidewalks. The arches vary in length from 152 to 208 ft. and are of the three rib type, the outer ribs being 11 ft. and the inner rib, 21 ft. wide, leaving about 12 ft. space between the ribs. The roadway of the structure will be over 80 ft. above the surface of the river.

The piers of the bridge are of concrete, separating into three shafts with the ribs, as seen in the



VIEW OF ONE OF THE SEVEN ARCHES OF THE GEORGETOWN BRIDGE, SHOWING MIXING PLANT AND STEEL CHUTING TOWER ERECTED ON SCOWS accompanying illustration. These piers were constructed within cofferdams after the water had been pumped out. The abutments of the structure are above the level of the river, placed on rock with reinforced concrete counterforts.

In the concreting work, a mixing plant and steel chuting tower, part of which is shown in the illustration, were erected on two scows bound together. Scows bring the sand and gravel and unload to the mixer, from whence the mixed concrete is hoisted up the tower and chuted to the job.

Because the Potomac is turbulent in the spring of the year, it was thought that centering supports might be in danger of being swept out during the spring floods. Accordingly, the plan adopted was the building of steel arch ribs erected on trestles fixed on scows and floating the ribs into place by the tide. The ribs are placed in position at high tide and as the tide ebbs, the ribs fall into place.

The new bridge was formerly designated as the Key Bridge, in memory of Francis Scott Key, author of the "Star Spangled Banner," whose former home is situated near the bridge, but subsequently the structure was named the Georgetown Bridge. In 1916 Congress appropriated $150,000 for plans, surveys and the purchase of lands, and $1,000,000 for construction, which amount was later increased to $2,000,000.

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Traffic Counts in Various States—II[*]

Brief Description of the Progress Made in Traffic Censuses in the Several States — Classifications Adopted — Results

By A. N. JOHNSON[†]

(Continued from January 12)

Iowa

Traffic counts were made at 47 stations on federal aid projects in 1917, and in 1918 at 87 stations, 40 of which were located on federal aid projects, an average of three stations per project. The counts were taken for a period of seven consecutive days from 7 a. m to 9 p. m.

In 1917 the traffic was classified according to motive power, as horse-drawn and motor-driven, and was also classified according to destination as, interurban, tourist, and town traffic. It is noted that 28.6% of the traffic was farm traffic, 46.9% interurban traffic, 6.5% tourist, and 18% town traffic.

Farm traffic included traffic between farm and town; interurban, from one town to another; tourist traffic, that originating outside of the state or within the state and bound for the outside; town traffic, that originating in the town and going into the country and return to town.

It is noted that the individual enumerators did not classify on the same basis and there resulted considerable variation in the results from the different stations.

The averages for 47 stations show that 86% of the traffic was motor-driven, the average traffic per day being 339 vehicles and 996 passengers. In 1919 the traffic census at 87 stations showed an average daily traffic on the inter-county road system of 300 vehicles per day, motor traffic 82.6%, horse-drawn 17.4%, farm to town, 47.1%, interurban 46.1%, interstate 6.7%. These stations were located in 36 counties.

The 40 stations located on federal aid projects showed an average daily traffic of 260 vehicles, motor-driven 78.5%, and horse-drawn 21.5%.

The classification of traffic in 1918 was different from that used in 1917. In 1918 farm to town traffic included the two classifications "farm" and "town," while the interurban classification was divided in 1918 into "interurban" and "inter-county." The 1918 classification, "interstate," was the same as the 1917 classification, "tourist."

The tally sheets classified vehicles as follows:

One-horse passenger; 1-horse freight; 2-horse passenger; 2-horse freight;—horse passenger;—horse freight; roadsters; touring cars; motor trucks; motorcycles; tractors; bicycles; farm machinery; saddle horses; pedestrians; loaded freight.

The number of passengers was also recorded.

Classification of traffic: Farm-town; interurban; inter-county; interstate.

In 1919 traffic counts were made at 107 stations, the following tabulation being a comparison of traffic for 1917, 1918 and 1919.

	1917	1918	1919
Average daily traffic	339	260	337
Motor-driven	86.1%	78.5%	90.3%
Horse-drawn	13.9%	21.5%	9.7%
Local traffic	93.5%	78.1%	76.6%
Through traffic	6.5%	21.9%	23.4%

The details of these traffic data are found in the state highway reports for 1917, 1918 and 1919 (1919 not yet published).

Kansas

Except in one instance, in cooperation with county officials, no traffic census has been taken.

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[*] From a paper entitled "Traffic Cenus" presented at the sixth annual convention of the American Association of State Highway Officials, Washington, D. C., Dec. 13-16, 1920.

[†] Dean, College of Engineering, University of Maryland.

Kentucky

No systematic census has been undertaken. A few traffic counts have been made but no uniform set of instructions or classification was used.

Maryland

A systematic traffic census has been taken at various points on the state highway system since 1912. At that time there were about 50 traffic stations. Since then stations have been added as additional sections of the state highways have been completed until in 1920 there were 191 stations covering about 1,600 mi. of highways. The counts have been taken once every month for one-day periods, usually from 12 to 14 hours, according to the time of the year.

As soon as a new state highway section has been opened, traffic counts have been secured. The enumerations are taken by the patrolmen, the points of observation being selected so as to represent as nearly as possible the traffic on that particular section of the road.

The classification and weight in tons of vehicles as shown on the tally sheets is as follows:

Vehicles	Tons
1-horse: Runabouts, open and top buggies	0.362
1-horse: Open spring wagons and covered delivery wagons	1.000
2-horse: Family carriages and hacks	0.562
2-horse: Delivery wagons, vans, farm wagons and dump wagons	2.500
2-horse: Farm wagons, drays and vans	3.500
4-horse: Farm wagons and drays	3.750
6-horse: Farm wagons and vans	4.250
1-horse carts	0.800
Ox carts	1.000
Motorcycles	0.225
2-passenger automobiles: Light weight machines	0.900
2-passenger automobiles: Medium and heavy weight machines	1.750
5-passenger automobiles: Light weight machines	1.125
5 and 7-passenger automobiles: Medium and heavy weight machines	2.250
3 and 4-passenger automobiles enclosed: Like taxicabs	2.000
Store delivery automobiles: Medium and heavy weight, with tops	2.250
¾, 1, 1½ and 2-ton hauling trucks	3.200
3, 4 and 5-ton hauling trucks	7.500
Passenger auto buses: Light weight machines	1.150
Passenger auto buses: Medium weight machines	3.000
Passenger auto buses: Heavy weight machines	4.250

The traffic census for a given station for one year is transferred at the central office to cards, the results being reduced to a tonnage basis. These summary cards show, for each class of vehicle, the tonnage for each month and tons per inch.

Maine

Traffic counts have been taken from 1916 to date. In 1916, 1917 and 1918 there were 18 stations at which the traffic was recorded, but at present there are 44 stations located at various points on the state highway system.

The traffic counts are taken for one week, the last week in August or the first week in September, extending each day from 7 a. m. to 7 p. m.

The tally sheets show two-hour periods, and a classification as follows:

Loaded 1-horse wagons; unloaded 1-horse wagons; loaded 2-horse wagons; unloaded 2-horse wagons; loaded 4-horse wagons; unloaded 4-horse wagons; 1-horse pleasure vehicles; 2-horse pleasure vehicles; rubber-tired horse vehicles; saddle horses; motorcycles; excessively heavy vehicles; motor runabouts; motor touring cars; loaded motor trucks; unloaded motor trucks.

A distinction was made between vehicles going in one direction and those going in the opposite. The counts were taken by persons with whom the State Highway Department had an agreement in regard thereto.

The average per cent. of horse-drawn vehicles, as noted at 6 stations in 1916, 1917 and 1918 is shown in the following table. The daily average of the total number of vehicles at 7 stations in 1916 varied from 1,207 to 200 and in 1920 from 2,667 to 197, the average being 514 in 1916 and 797 in 1920.

	Per cent. horse-drawn vehicles	Per cent. motor vehicles
1916	15	85
1917	12	88
1918	10	90

Massachusetts

Four traffic counts have been made, in 1909, 1912, 1915 and 1918, respectively. The counts were taken from 7 a. m. to 9 p. m. The observation stations were on the main through roads and so selected as to be away from the influence of merely local village traffic.

In 1909 the census was taken at 238 stations, in 1912 at 156 stations, in 1915 at 192 stations and in 1918 at 57 stations. The counts were made for seven consecutive days in August and again in October. At a few important points the count was made at night, covering the entire 24 hours.

The classification of vehicles was as follows:

1-horse vehicle, light; 1-horse vehicle, heavy; 2 or more horses, heavy; motor truck or bus, small; motor truck or bus, 1-ton or more; automobile.

A summary of the traffic enumerations made at different times is found in the report of the Massachusetts Highway Commission of 1918, pp. 50-57, also appendix J.

Based upon average counts at 44 stations on main lines the increase in motor traffic from 1909 to 1918 was 661%, with a total decrease of horse-drawn vehicles of 62½%, and a net total gain of all vehicles of 243%. It is noted that in 1909 there were practically no trucks; in 1912, 17; in 1915, 45; and in 1918 there was an average of 75 recorded daily. In 1909 horse-drawn vehicles constituted 57% of all of the traffic; in 1918, 6% of the traffic. During the three years 1916-1919, it is noted that motor traffic had increased at the rate of 22% a year.

No reduction of the results to tonnage basis is indicated.

(To be concluded)

Researches Leading to the Adequate Design of Roads for Heavy Motor Trucks—I*

By A. T. GOLDBECK†

The heavy motor truck which has come upon us within the past few years and which promises to increase in numbers, imposes an entirely new problem of design and a far more complicated problem that has ever existed before. We no longer need regard the abrasive wear of the higher types of roads with much concern, for by proper maintenance we can take care of abrasion. The development of the design for light, fast moving rubber-tired traffic may also be considered as practically accomplished. But the problem of how to design a road to carry heavy concentrated loads under all conditions, without fear of structural failure, remains unsolved; and this is our most important problem in road design today. The governing traffic unit in the present-day design is the heavy motor truck, and when we have built our road to take care of this unit under all conditions we need not fear for the adequacy of the road for any other class of traffic.

Before considering what researches should be undertaken to gain the necessary information to serve as a basis for adequate road design for heavy motor trucks, it will be well to stop and review briefly the character of failures that have resulted on some of our roads through use of heavy trucks. General observation of roads that have failed under heavy trucks invariably reveals what has been termed a "structural failure." Such a failure involves not only the road slab but also the subgrade. It is brought about by a combination of exceedingly heavy loads and a very soft condition of the subgrade. Had the poor subgrade condition not existed, complete structural failure would not, in general, have resulted. Failures of this kind have involved entire stretches of roads, or in many cases have occurred in spots, which, coupled with evidences of incipient failure of the road as a whole, have led to the conclusion that a short period of still more unfavorable subgrade conditions would probably cause general failure of the entire road surface. Where exceedingly heavy units of traffic are not in general use and where the subgrade is of good supporting value, complete structural failures are hard to find, but they are numerous where this condition does not exist. Minor defects, such as cracks, which might be regarded as incipient failure, are brought about in many cases by the action of heavy traffic. It is recognized, of course, that there are in addition other causes for initial failure of the road. It is recognized, too, that heavy traffic produces other defects in the road surface depending on its type, but such such defects are insignificant and can be taken care of by maintenance or comparatively inexpensive resurfacing in the future.

It will not be amiss to review the mechanics involved in the design of roads, in so far as this is possible. When we consider the design of any structure built to carry loads we must know with reasonable accuracy what will be the maximum load. The motor truck as it is commonly built at present has its weight distributed on four wheels with as much as 80% of the gross load carried on the two rear wheels. The road surface then must support four concentrated loads, the maximum concentration being not uncommonly 12,000 lb. on a single wheel. This is not a quiescent load, for the truck is in motion and the road surface is never perfectly smooth. The sprung and unsprung weights of the vehicle are set into vertical motion, and thus, instead of a static force, we have a suddenly applied load or even an impact. The concentrated load imposed on the road is distributed to the underlying subgrade. If the wearing surface possesses slab strength, or if it does not possess slab strength but is of comparatively great thickness, the concentrated load is distributed over a considerable area of the subgrade and becomes a load of varying intensity, with highest intensity directly under each wheel and gradually diminishing away from the wheel.

Soils composing the subgrades of roads are limited in their bearing value, particularly when they have become soaked with water. It is a matter of common observation that certain soils when water soaked approach a state of fluidity and will hardly support the lightest load. It will readily be appreciated that heavy concentrated wheel loads may impose pressure on the subgrade of greater magnitude than the bearing value of the soil. Under such conditions the subgrade material naturally deforms and immediately great stress is thrown into the wearing surface through flexure. When the subgrade is of very high bearing value, as it invariably is when dry, it yields practically not at all under light pressure distributed to it by the wearing surface and under such conditions the flexural stress under the load is likewise small.

Enough investigations have been made thus far to indicate that the support offered by the road subgrade is anything but constant and anything but

(Continued on page 26)

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*Paper presented at the sixth annual convention of the American Association of State Highway Officials, Washington, D. C., Dec. 13-16, 1920.

†Engineer of Tests, Bureau of Public Roads.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI JANUARY 19, 1921 No. 3

SYSTEM IN ROAD BETTERMENTS

Lack of a well ordered, definite program has hindered road work very seriously in more than one instance. Only in comparatively recent years have the state highway departments been working to complete systems planned to meet the needs of traffic and even now improvements are too frequently made merely to satisfy local demands, to meet the exigencies of the present or to provide for the immediate future.

The "hit or miss" selection roads for improvement has nothing to commend it. It wastes the people's money and the efforts of the highway department and it does not provide roads to carry the traffic. It results in a system—or rather a collection—of roads that "begin nowhere and end nowhere," that are difficult to maintain, and that cost more and yield less than a smaller mileage of roads comprising a real system.

In these days there is no reason, except the interference of petty politics, for failure to adopt a definite system of roads of various classes and to then go to work to improve that system in an orderly and effective manner. It is understood, of course, that more or less modification of the layout will be necessary from time to time. Changes are demanded by the development of new agricultural areas, new pleasure resorts, the shifting of population and of industries, and by other causes. But the main routes of travel change but little except in long periods of time.

The majority of states have now commenced work upon carefully planned road systems. Those that have not done so should make it the first business of their road improvement programs. In addition, the same principle should be applied in the smaller administrative units and steps should be taken to coordinate the state systems into a nation-wide system.

THE HIGHWAY'S PLACE IN A NATION-WIDE TRANSPORTATION SYSTEM

The larger public interest will be served best by the transportation system that is so developed that each transportation agency will be utilized to the extent that it is economically desirable, according to Daniel Willard, President of the Baltimore & Ohio Railroad.

This view was expressed in a paper presented at the recent annual meeting of the American Society of Mechanical Engineers. An abstract of the paper is printed on other pages of this issue.

It requires no deep study of transportation problems to reach the conclusion noted; and mention of it is made here not because it is unusual, but because it indicates a decided change in the attitude of railroad men towards highway transportation. Evidence of this modification of views was also noticed in some of the other papers presented at that meeting.

It is not to be expected that highway transportation will supplant entirely other methods. In spite of the phenomenal development of American railways, water transportation has always been used. As a matter of fact, it should have been employed to a greater extent than it has, and would have had not other than economic considerations influenced its use. Rail transportation also will remain in use, though certain business now handled by the railroads will be diverted to the roads as truck transportation is developed to higher and higher degrees of efficiency and economy.

What has been called "the trinity of transportation"—waterways, railways and highways—will divide the country's transportation in the future, as in the past. As expressed in the abstract of Mr. Willard's paper, to which reference has been made, "Each transportation agency should be used to the extent that such use is economically desirable." Continuing, he suggests that there has been a tendency for those particularly interested in one or another form of transportation to attempt to extend the use of that agency beyond its proper economic limits, and says:

"I think there should be an intelligent effort to develop all agencies of transportation, each within its own sphere, but also so coordinated with each other as to constitute a nation-wide system which would approximate in its effectiveness the efficiency of the telephone system."

"This view, we believe, will be shared by all who have given the subject any thought. And it is a pleasure to find Mr. Willard so absolutely right on a matter of highways—he is the man who early last summer proposed that road building be curtailed in order to divert labor to farm work.

Researches Leading to the Adequate Design of Roads for Heavy Motor Trucks

(Continued from page 24)

uniform. It has been shown very definitely that the subgrade support changes with the varying moisture content and with the effect of frost. In fact, instances have been observed in which the road surface has been left without support over large areas. Under such conditions considerable stress must be produced in a rigid slab under the action of traffic. Such conditions are brought about, however, mainly through inadequate preparation of the subgrade and through inadequate drainage.

From the foregoing brief discussion it would seem that our road design problem of today is very decidedly a problem of structural design; and that it does not stop at the design of the wearing surface alone, but that it involves the proper design of the underlying subgrade. We must adequately support the slab and we must design the slab so that it will not fail under heavy loads.

When one approaches a problem of design of any structure the knowledge required involves, first, knowledge of the forces to be imposed upon that structure; second, knowledge of the manner of distribution of stress throughout the structure; third, knowledge of the behavior of the materials used when subjected to stress. Researches for the adequate design of roads for heavy motor trucks must include then:

1. Investigation of the forces on the road surface produced by heavy motor trucks.
2. A determination of the distribution of these forces through the wearing surface and subgrade.
3. An investigation of the behavior of the road surface and subgrade materials under the action of these forces and other forces produced by natural causes such as temperature and moisture changes.

In the present discussion it is not the purpose to outline in detail the various investigations which must be made in connection with the three broad general problems just mentioned. It will be well, however, to call attention to a number of these researches in order to indicate in a general way why they are necessary and how they might be carried out.

1. Investigation of the Forces on the Road Surface Produced by Heavy Motor Trucks

It is apparent to anyone who has stood on a road surface during the passage of a fast moving heavy truck that the surface is being subjected to a considerable force, a force far in excess of the static weight of the vehicle, and this is evidenced by the vibrations produced under the action of the truck. It is apparent that the road is being subjected to a variable force as the truck rolls along and that in many places severe impacts are delivered by the wheels of the truck. Just why should this be so? It would seem that with road surfaces as smooth as we are able to make them under the present day methods of finishing, trucks should roll along with practically no vibration, but it is surprising just how much effect a slight inequality will produce in causing the truck wheel to actually leave the surface. For illustration, it has been observed that the rear wheel of a heavy army truck moving at 20 mi. per hour apparently cleared the road surface by at least 1 in. in passing over a slight inequality due to a small excess of bituminous filler in an expansion joint. But what force exists on the road surface when the truck wheel lands under such conditions and why should there be any extraordinary force produced? Let it be remembered that when a truck wheel is clear of the road surface there is an enormous force in the truck springs tending to bring it back to the surface. In consequence of the spring compression, when the wheel again comes into contact it has attained high vertical velocity. The truck tire is compressed as soon as again in contact with the road surface which then exerts an upward force, finally reducing the vertical velocity to zero. In other words, the force existing between the road surface and the tire has decelerated the downward vertical velocity of the portion of the truck beneath the springs. Now, it is an old law in physics that force is equal to mass times acceleration and since the mass of the unsprung portion of the truck is brought to rest vertically on the road surface, or decelerated, there must have been required a reaction between the road surface and the tire at least equal to the mass of the unsprung portion times the deceleration of that portion, and in addition to this force there must be added the force due to the compression of the spring. The longer the time required to bring the unsprung portion to rest vertically the smaller becomes the deceleration and consequently the lower the force. This explains why pneumatic tires are apt to prove so much lighter in their destructive effect on the road than solid tires, and likewise explains immediately why steel tires have such a destructive effect.

If in the future we plan to design our roads in a purely rational manner, is it not plain that we must find out all there is to be known of the varous forces acting upon the road? The heavy forces of traffic are vitally important. Very complete investigations should be made of the various kinds of motor vehicles when fitted with various kinds of tires, for the tires play an important part in easing the effect of the blow. Such researches* have already been carried out extensively by the Bureau of Public Roads and thousands of tests have been made. These tests, which have been made under artificial impact conditions, should be followed by impact tests made on actual roads in order to obtain an idea of the relative destructive effect of traffic due to varying degrees of smoothness. Such investigations will shortly be made by the Bureau of Public Roads, using an apparatus which permits of drawing a curve from which the vertical acceleration of the sprung and unsprung portions of the motor vehicle may be obtained and thus the forces on the road surface may be calculated. This apparatus is now partially successful and it is believed it will be possible to make it produce very satisfactory results. It would seem that the results of tests of this kind at some future date might be used in motor truck legislation, but before this is done tests will be necessary to show the relation between the force to be expected from motor trucks and the destructive effects produced by these forces.

(To be concluded)

Short Courses in Highway Engineering At University of Michigan

The winter short courses in highway engineering at the University of Michigan will be given from Jan. 10 to March 15. Any man over 21 may take the courses and college graduates with a bachelor's degree may become candidates for the master's degree. The subjects to be given are as follows, each course covering two weeks:

Jan. 10 to 21.—Earth, sand-clay, gravel and broken stone roads. American and English highway transport methods.

Jan. 24 to Feb. 4—Bituminous surfaces and bituminous pavements. Interrelationship between highway, railway and water transport.

Feb. 7 to Feb. 18.—Mechanism, operation and maintenance of motor trucks, tractors and trailers. Highway structures. American and English highway traffic legislation and regulations.

Feb. 21 to Feb. 25.—Seventh annual Michigan Conference on Highway Engineering and Highway Transport.

Feb. 28 to Mar. 11.—Brick, cement concrete, stone block and wood block pavements. Highway engineering seminar. Highway transport management, costs and record systems.

Mar. 14 to Mar. 25.—Highway engineering financing, administration and organization. Highway transport seminar.

In addition to the members of the faculty, a number of non-resident specialists will deliver lectures in the several courses.

Oregon Bridge Christened With Root Beer

A concrete bridge, near Roseburg, Ore., on the Pacific Highway, was opened on Christmas Day and christened with a bottle of root beer.

Wages of New Jersey Road Laborers Cut

All the common laborers in the employ of the New Jersey State Highway Department had their wages reduced 10 ct. per hour, beginning Jan. 16. These laborers formerly received 40 to 65 ct. per hour.

Bridge at Toledo, Washington, Completed

The steel bridge over the Cowlitz River at Toledo, Wash., has been completed and accepted by the state. Nearly two years were required for the construction of this bridge, which is 800 ft. long. The roadway is 16 ft. wide and paved with asphalt, and cluster lights have been installed at the bridge approaches.

New Ohio Governor Wants Goethals to Reorganize Highway Department

Harry L. Davis, recently elected Governor of Ohio, has asked Maj. Gen. George W. Goethals to confer with him upon the reorganization of the State Highway Department. The action of the governor is thought by many to mean the abolition of the Highway Advisory Board and the placing of responsibility in the state highway commissioner.

Highway Education Committee Appoints Director

C. J. Tilden, Professor of Engineering Mechanics at Yale University, has been granted leave of absence for one year to accept the position of director of the Highway and Highway Transport Committee of the U. S. Bureau of Education.

This committee, which was formed last May, includes, P. P. Claxton, U. S. Commissioner of Education; Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads; Col. M. M. Patrick, Corps of Engineers, U. S. A.; Roy D. Chapin, President, Hudson Motor Car Co.; W. S. Keller, State Highway Engineer of Alabama, H. S. Firestone, Firestone Tire Co.; and Dean Bishop of the University of Pennsylvania.

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*A report of these tests will be issued very soon by the Bureau of Public Roads.

Road Work in West Virginia

During the eleven months ending Nov. 1, the State of West Virginia spent $2,478,000, according to a recent announcement by the State Road Commission. Of this amount, $322,591 was from state funds, $793,873 from federal aid funds and $1,361,535 from county funds.

Slide Blocks Columbia River Highway

A slide on the Columbia River Highway between Hood River and Mosier, Ore., on Dec. 24 left about 1,000 cu. yd. of earth and rock upon the roadway, just west of the twin tunnels. The road has been opened to traffic, but much of the slide will not be removed before spring.

Completion of Forest Road in Navajo County, Arizona

Bureau of Public Roads Has Accepted Section of Road in the Sitgreaves National Forest

Section 2 of the Snowflake-Pinetop Road in Arizona, a large portion of which is in the Sitgreaves National Forest, has been completed and was accepted recently by the District Engineer E. S. Wheeler, of the Bureau of Public Roads.

On May 5, 1919, the Bureau of Public Roads entered into a cooperative agreement with the Board of Supervisors of Navajo County, Arizona, for the survey, construction and maintenance of the Snowflake-Pinetop Road. This highway is 38.6 mi. in length, and 30.8 mi. are located within the Sitgreaves National Forest. The Department of Agriculture agreed to provide not more than $92,000 toward the construction cost from the appropriation available for work on roads and trails within the national forests. The total estimated cost was $152,000 and Navajo County agreed to contribute $60,000.

The contract for Section 2 was awarded to Rogers Bros. on July 19, 1919, this covering a section 14.8 mi. long, extending from the Indian Reservation line to the town of Showlow. The total final cost under the contract was $23,763. The completed contract included 32,985 cu. yd. of common excavation and 1,277 cu. yd. of rock excavation.

A contract for Section 1, 22.8 mi. in length, has been awarded recently to the same contractor at an estimated cost of $80,639.50.

The Snowflake-Pinetop Road is one of the most important highways in the Arizona National Forest. At Snowflake it connects with a county road leading northerly to Holbrook on the Santa Fe Railway, and at its southern terminus it connects with another important highway leading southerly through the White Mountain Apache Indian Reservation to a point on the Arizona Eastern Railway. Its construction will make more accessible several million feet of merchantable timber and will prove of great benefit to farmers at Showlow, Pinetop, Taylor and other points.

Ohio Convicts Make Paving Brick

More than 3,000,000 paving brick were manufactured at the state brick plant near Junction City, Ohio, during 1920. The work was done by convicts.

The capacity of the plant is 15,000,000 brick annually, but because of car shortage and other causes, the plant was not operated on full time for several months. However, it is expected that the plant will be operated to capacity this year.

Adopt Specifications for "Ideal" Section of Lincoln Highway

Recommends That Section be of Concrete, 10 in. Thick, With a 100-ft. Right of Way

The Technical Committee of the Lincoln Highway Association recently met in New York City and adopted general specifications for the "ideal" section of road which the association plans to build. The specifications are subject to review at a final meeting of the committee and their general provisions are substantially as follows:

The section will be built to accommodate 15,000 passenger automobiles traveling at 35 mi. per hour, and 5,000 motor trucks traveling at 10 mi. per hour. per day. The final specifications are to be predicated upon ultimate regulation of trucks limiting loads to 800 lb. per inch width of tire and 8,000 lb total per wheel. The right of way will be 100 ft. wide; drainage to be effected by submerged drain tile and catch basins. The pavement will be 10 in. thick, of reinforced concrete, with earth shoulders. The section will be lighted and footpaths provided for pedestrians. Curves are to be eliminated when possible and no curve is to have less than 1,000 ft. radius, with superelevation for a speed of 35 mi. per hour. Grade crossings will be eliminated and guard rails and warning signs will be provided when necessary. It is further recommended that all wires be placed underground, that advertising be forbidden along the road, and that comfort stations be provided. At all intersections obstruction to the vision should be removed for a distance of 500 ft. each way from the intersection.

———ooo———

The Maryland State Roads Commission has reduced the wages of laborers employed on maintenance work 25 ct. a day.

Mississippi County, Missouri, passed a $140,000 road bond issue on Dec. 1 by a vote of more than 10 to 1. The total official vote was 1,154 for to 49 against the measure.

HIGHWAY TRANSPORTATION

A Comprehensive Transportation System*

By DANIEL WILLARD†

It is in the larger public interest that in developing a transportation system which will be adequate to meet the transportation requirements of our growing commerce, each suitable agency of transportation should be used to the extent that it is economically desirable. To be more specific, where a given expenditure, if applied to water transportation, will provide for the movement of the traffic offered at a lower economic cost, including interest on investment and cost of maintenance, than would be the case if an equal investment were made in any other transportation agency, then in such cases the water transportation should be developed. Also, if the use of the motor truck on improved highways in certain localities and for certain distances is shown to be cheaper, including interest on investment and cost of maintenance, than any other method available, then that form of transportation should be made use of under such conditions.

Each transportation agency should be used to the extent that such use is economically desirable. To make less use than that of each available agency would be wasteful and uneconomic, and if a more expensive agency were used when a less expensive one might be equally available, that practice would also be wasteful and uneconomic. I think that in the past there has been a tendency on the part of those interested in some particular agency to try to extend its use, in many instances, beyond the proper economic limits, and this has resulted in unwise expenditures which in the end proved to be uneconomic and consequently unprofitable. Such mistakes ought to be avoided in the future.

I do not believe that the motor truck, as now developed and operating on any form of highway, can compete in the carriage of long distance traffic with the steam locomotive running on a steel girder properly supported. I do believe, however, that for short distance traffic and in sparsely settled communities, the motor truck, not only on the improved highway, but even on the ordinary dirt road, may be used in conjunction with the railway and thus afford the cheapest form of transportation.

I think there should be an intelligent effort to develop all agencies of transportation, each within its own sphere, but also so coordinated with each other as to constitute a nation-wide system which would approximate in its effectiveness the efficiency of the telephone system.

There was a time when railway managers were believed to be opposed to the development of other means of transportation, which might become competitors for the business which they were hauling or desired to haul. But whatever may have been the attitude of the railway managers in the past, that is not their attitude at the present time.

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*Abstracted from a paper presented at the 41st annual meeting of the American Society of Mechanical Engineers, New York, N. Y., Dec. 6-8, 1920.

†President, Baltimore & Ohio Railroad.

Motor Truck Transportation*

By FRANCIS W. DAVIS†

I come before you today not to plead for the motor truck, but to show its proper application and the important part it should play in the general scheme of transportation. In the short period of 20 years motor highway transportation, in capital invested and diversified fields of application, has reached the point where it is warranted in seeking council with its elder brothers in transportation. Except for certain specialized services the motor truck will never replace waterway and railway transportation, nor act in other than a supplemental capacity to these two.

The problem has three main aspects:

1. The field of truck transportation.
2. The present status of truck transportation.
3. The improvement of truck transportation.

The Field of Truck Transportation

In cheapness, capacity and low operating costs, waterways, where available, present the most economical form of transportation, especially for bulk material. There is, and can be, but little competition.

The railways are our main reliance for overland transportation, handling approximately 400,000,000,000 ton-miles a year. Despite the complexities of their present problems they are discharging a remarkable service, when compared with foreign railway systems. But they are not able at the present time to take care of all the traffic. For various reasons the increase in railway equipment during the past five years has not kept pace with the increase in traffic. To meet existng shortages, provide for retirements and for the normal growth in traffic it is estimated that the railroads would require in the next three years something like 25,000 passenger cars, 700,000 freight cars and 14,000 locomotives, not to mention sidetracks, signals, shop equipment, engine houses, etc. The above requirements will cost in the neighborhood of $5,000,000,000 to $6,000,000,000. It is doubtful if the railroads can add this equipment in that time for two reasons: First, the inability to secure the necessary capital, and second, the impossibility of manufacturing so vast an amount of equipment within that tme. The solution, or at least an alleviation, must be looked for in some other direction.

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*Paper presented at the 41st annual meeting of the American Society of Mechanical Engineers, New York, N. Y, Dec. 6-8, 1920.

†Engineer, Pierce-Arrow Motor Company.

It is in the "short haul" and at terminal points that the railways are at greatest disadvantage, both as to service rendered and to their own earnings; and it is here that motor transportation comes as a help and releases cars for the long hauls where they are most efficient. The railways have not always considered the motor truck as an ally, but the two cooperate far more than they compete, and the railroad is at one end or the other of most truck hauls.

TABLES I AND II

COMPARISON OF THE COST OF DOOR-TO-DOOR DELIVERY OF FIRST CLASS L. C. L. FREIGHT

Table I—From Buffalo to various points.

Buffalo to	Miles	Flat Freight Rate	Total Cost by rail per 100 lb.*	Time by Freight (days)	Truck Rate per 100 lb.[1]	Time by Truck (hours)[2]
Tonawanda	10	.25	.83	2	.25	2
Niagara Falls	26	.28	.87	2	.35	4
Batavia	37	.31	.90	2	.60	5
Rochester	72	.38	.99	3	.80	9
Jamestown	77	.54	1.17	2	.90	9
Erie	92	.59	1.23	2	1.00	10
Ashtabula	129	.67	1.32	3	1.30	14
Elmira	145	.61	1.25	4	1.40	15
Syracuse	154	.56	1.20	2	1.50	16
Utica	203	.66	1.31	3	2.00	21
Binghamton	204	.70	1.36	3	2.00	21
Pittsburgh	241	.84	1.52	5	2.50	26
Albany	308	.72	1.38	4	3.00	31

Table II—From various points to New York City.

To New York City from	Miles	Flat Freight Rate	Total Cost by rail per 100 lb.*	Time by Freight (days)	Truck Rate per 100 lb.[1]	Time by Truck (hours)[2]
New Rochelle, N. Y.	17	.42	1.03	1	.25	3
Stamford, Conn	34	.48	1.10	1	.60	4½
Bridgeport, Conn.	57	.56	1.20	2	.75	7
New Haven, Conn.	74	.59	1.23	2	.80	8½
Hartford, Conn.	109	.63	1.28	5	1.10	12
New London, Conn.	127	.70	1.36	5	1.30	14
Springfield, Mass.	150	.63	1.28	7	1.50	16
Providence, R. I.	185	.74	1.41	4	1.90	20
Gloucester, Mass.	201	.85	1.54	7	2.00	21
Fall River, Mass.	220	.74	1.41	5	2.20	23
Boston, Mass.	233	.74	1.41	4	2.40	25
Lowell, Mass.	259	.79	1.46	7	2.60	27

*Total cost by rail per 100 lb. equals freight rate plus teaming charges both ends (.30) plus cost of extra boxing (.24) plus extra freight charge on increased weight of boxing (17 per cent. of freight rate.)

[1] Trucking Association figures (1920).

[2] Loading and unloading time of 1 hr. plus running time at 10 m. p. h.

Where they do compete, as in the short haul, the problem is to determine which is best suited to discharge the service, where the advantages shift from one to the other, and let each specialize in the field where it is the more efficient and economic.

The writer has been informed that express companies are not allowed by their contracts with the railroads to ship to any point where they maintain an office and advertise tariffs, by any other means than by rail, irrespective of the distance. This would apply to such a point as Germantown. Though seemingly a part of Philadelphia, this is an express point and the express company would be obliged to ship by rail. If the express company could save by using motor trucks in short haul suburban service of this character, the practice is uneconomic.

The ratio of labor required to tonnage handled precludes the competition of motor trucks with the railway on the long haul. A modern freight train with a crew of six men might move 3,000 tons where it would require 600 5-ton trucks with 600 drivers to do the same work.

The accompanying tables show the relative costs of shipping by rail and truck for various lengths of haul. The point where railway transportation becomes the cheaper is obviously governed by special conditions and no general limt can be given. The figures for the railway include freight charges, teaming between terminal points and the increased cost and freight on boxing for railroad shipment.

With the proper coordination the motor truck can aid materially in lowering terminal and transfer charges. The results obtained in Cincinnati, covering the use of motor trucks with demountable bodies, show the possibilities in the solution of terminal problems. Sixteen motor truck chasses with 225 unit-container interchangeable bodies were put into operation, and electrically operated hoists were installed at the terminal points for lifting and conveying the bodies. Although the truck loads average 455 tons the operation of removing one filled body and replacing with another requires only approximately 5 minutes.

"Under the old system it took an average of 62.4 hours to move freight by trap car between connecting lines, 55.2 hours by trap car between main and substations, and 72 hours by transfer company—an average of 62.4 hours. Now 98% reaches destination in time for loading into main line cars, or for consignee's delivery at sub-stations within the current 10-hour day." Over 50% has been saved in platform space. Walker D. Hines, Director General, reports in connection with this installation, in addition to quickness of dispatch, a "saving of two handlings; 50% decrease in damage to freight in loading and unloading, and decrease of about 15% per ton in cost of handling."

(To be continued)

MEETINGS

Calendar of Coming Meetings

Jan. 19—American Society of Civil Engineers.—Annual meeting, New York, N. Y. Secretary, Charles Warren Hunt, 33 W. 39th St., New York, N. Y.

Jan. 25-27—Associated General Contractors of America.—Annual convention, New Orleans, La., Chicago, Ill.

Feb. 9-12—American Road Builders' Association.—Eighteenth Annual Convention, Eleventh American Good Roads Congress and Twelfth Good Roads Show under the auspices of the A. R. B. A., The Coliseum, Chicago, Ill. Secretary, E. L. Powers, 11 Waverly Place, New York, N. Y.

American Road Builders' Association

The good roads movement will receive a strong impetus when good roads advocates and road builders from all parts of the United States, Canada, Cuba, Porto Rico, Hawaii and Alaska, get together in Chicago, Feb. 9 to 12, for a gigantic good roads congress to be held under the auspices of the American Road Builders' Association. New York City and state and eastern road builders and road users in general will take a most active part in the proceedings.

Road work in 1921, for which practically $1,000,000,000 has been made available, as a partial remedy for the unemployment conditions that exist throughout the country, will be one of the principal subjects considered, according to officers of the American Road Builders' Association.

The safety of motor cars, trucks and other vehicles on the highways of the country and especially the dangers to their occupants at railroad grade crossings and on the bridges and culverts, is another subject that will receive a great deal of attention at the congress.

It is estimated that there are about 400,000 bridges of more than 5-ft. span in the United States. According to Willis Whited, Bridge Engineer of the Pennsylvania State Highway Department, it is probable that more than 80% of these are unable to carry a thoroughly modern truck, with an ample margin of safety. A majority of the bridges consist of a single span of wooden stringers with plank floor. Better construction and inspection of these bridges is one of the advances which members of the American Road Builders' Association are advocating and it is likely that a vigorous campaign will be inaugurated at the Chicago good roads meeting with those ends in view.

The constantly increasing number of grade crossing accidents, too, is a subject that is expected to cause considerable discussion at Chicago in connection with the growing demand for the elimination of grade crossings. Automobile accidents of one kind or another on the public highways killed 7,969 persons in 1919, according to the census figures for 1920, covering the Census Bureau's registration area, which embraces 80% of the country's population. A total of 3,808 deaths occurred on the streets of the 66 largest cities of the country. The deaths in 1919 from automobile accidents in the registration area showed an increase of 444 over those of 1918.

The Chicago meeting promises to be one of the greatest in point of attendance and in results ever held in the history of the good roads movement.

At a big mass meeting addresses of welcome will be delivered by Governor Small of Illinois, and Mayor Thompson of Chicago. The response will be made by the president of the American Road Builders' Association, Michael J. Faherty, President of the Board of Local Improvements, Chicago.

A feature of the congress will be an elaborate demonstration by the Federal Bureau of Public Roads, showing the actual conduct of the impact tests the bureau is making to determine the ability of different soils to sustain roads. There will also be actual tests of road materials.

Texas Roadbuilders' Association

The annual business meeting of the Texas Roadbuilders' Association will be held at Austin, Tex., on Jan. 19, 20 and 21. Because of the drafting of a new road law to be presented to the Legislature, few addresses or papers will be presented.

West Virginia Road Building Contractors' Association

A number of highway contractors in West Virginia met in Wheeling, W. Va., on Dec. 27, and organized the West Virginia Road Building Contractors' Association. J. P. Mumaw was elected president and T. J. Bartrue, secretary.

New Jersey Highway Contractors' Association

The first quarterly meeting of the New Jersey Highway Contractors' Association was held on Jan. 5 at the Trenton House, Trenton, N. J., with 50 members in attendance. Following the business meeting, a banquet was held, with Joseph Burk, of Plainfield as toastmaster.

Kansas Engineering Society

The thirteenth annual convention of the Kansas Engineering Society was held on Dec. 16 and 17 at Topeka, Kan. Among the speakers were F. W. Epps, Bridge Engineer of the Kansas State Highway Department, who talked on bridge development in Kansas; H. S. McFadden, of the Kansas Engineering Co., on highways; W. E. Baldry, City Engineer of Topeka, and P. L. Brockway, City Engineer of Wichita, on use of paving materials.

Officers were elected as follows: President, P. L. Dean, Kansas University; Vice President, L. B. Smith; Secretary, J. M. Averill.

Lee Highway Association

The first annual convention of the Lee Highway Association is being held at Knoxville, Tenn. The first session was held yesterday and the meeting will end tomorrow. The Lee Highway connects New York City with New Orleans. Among the speakers on the program are: C. H. Brough, Governor of Arkansas; A. G. Batchelder of the American Automobile Association; H. G. Shirley, Secretary, Federal Highway Council.

The officers of the Lee Highway Association are: President, D. D. Hull, Jr.; Secretary-Treasurer, John Wood, Roanoke, Va. S. M. Johnson has been appointed director-general of the association.

PERSONAL MENTION

F. W. Austin has been appointed city engineer of Chanute, Kan.

E. P. Asbury has resigned as engineer for Collin County, Texas.

F. W. Cawthon has been appointed engineer of Collin County, Texas.

Albert Hill has been appointed maintenance engineer of Collin County, Texas.

L. Myles has been appointed county engineer of Victoria County, Ontario, Canada.

J. E. Huber has resigned as district engineer of the Illinois State Highway Department.

L. N. Edwards, formerly Senior Highway Bridge Engineer with the U. S. Bureau of Public Roads, is now bridge engineer with the Maine State Highway Department.

—ooo—

A Road Bond Petition of Vermillion County, Indiana, for the issuance of $470,000 road bonds, has been denied by the State Board of Tax Commissioners.

Limestone County, Texas, recently defeated a proposed $75,000 road bond issue. The measure was defeated by 37 votes and another election has been asked.

The Town of Reading, Mass., has been indicted by the Middlesex County Grand Jury on a charge of criminal neglect in failing to maintain a highway in a proper manner, according to a recent press report.

The Louisville Boat Club, of Louisville, Ky., recently made a plea to the Fiscal Court asking that a wall be built along the River Road so as to prevent the river from washing the road away. A part of the bank was carried out by the river in 1913 and since that time parts of the bank have been gradually slipping away.

The Freeholders of Cumberland County, New Jersey, have unanimously decided to enter into a contract with the State Highway Commission to finance the improvement of the state road between Bridgeton and Shirley, and South Second St., Millville, with the understanding that the state will reimburse the county next year.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Old Series, Vol. LX
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JAMESTOWN, N. Y., JANUARY 26, 1921

Number
4

Highway Development in the United States

A Review of the Work and Expenditures in the Various States in 1920 and Programs of Highway Construction of State Highway Departments for 1921

Although many millions of dollars were available for highway improvement in 1920, approximately half of the highway funds of the various states and counties was carried over to 1921. Besides this sum, several hundred millions of dollars were voted by states and counties last year, which, added to unexpended funds, makes nearly one and one-half billion dollars available for highway work in 1921. While it is hardly probable that a billion dolars will actually be expended in 1921, the fact remains that everywhere the funds are avaiable for highway improvement and that as the conditions of labor, transportation and money become more stable, road construction will proceed with increased speed.

Alabama

The State of Alabama in 1920 spent $811,733 federal, $300,000 state and $800,000 county funds for highway improvement, building 138 mi. of federal and state, and 100 mi. of county roads. During the past year a $25,000,000 state bond issue and $5,450,000 county bond issues were passed, and $868,474 in motor vehicle fees collected. Funds for 1921 consist of $2,846,864 federal, $2,796,864 state and $1,000,000 county funds. The highway program for the coming year calls for the construction of 65 mi. of bituminous macadam, 4 mi. of asphalt, 67 mi. of sand-clay and 183 mi. of gravel roads, and the construction of a concrete bridge 900 ft. long.

Arizona

Arizona is now compiling its report for the year 1920, according to information received from W. J. Jamieson, Office Engineer. Information covering the activities of this state will be published shortly in GOOD ROADS. Maricopa County has passed two road bond issues totaling $8,500,000 and has started the work of building 280 mi. of concrete highways.

Arkansas

Arkansas had under contract last year 464 mi. of earth, 2,326 mi. of gravel, 451 mi. of macadam, 309 mi. of penetration macadam, 300 mi. of asphaltic concrete, 187 mi. of cement concrete and bridge structures, etc., at an estimated cost of $56,010,000. Approximately 30% of this work was completed at the close of the year, with about $21,760,000 of available funds for payment on contracts carried over.

California

The California Highway Commission during 1920 spent a total of $7,500,000 federal and state funds, grading 113 mi. of road and building 112 mi. of Portland cement concrete base and surfacing 10 mi. with asphalt. A total of $2,323,264 was received from motor vehicle fees. At the November election the voters authorized the raising of the interest rate on state road bonds, thereby making available about $40,000,000 of bonds which had been unmarketable.

Colorado

Colorado had in 1920 about $1,700,000 federal, $2,300,000 state and $3,500,000 county road funds available, building about 100 mi. of earth and gravel roads and 28 mi. of other roads. A $5,000,000 state road bond issue was passed and $818,000 in motor fees collected. For the present year $1,720,000 federal, $4,500,000 state and $4,000,000 county funds are available for highway improvement. It is planned to build 167 mi. of earth and 28 mi. of paved roads this year.

Connecticut

The State of Connecticut had $1,310,356 federal and $9,568,734 state funds available in 1920, spending $134,796 and $5,499,569, respectively. Sixty-three miles of paved roads were built and $1,816,809 collected from motor vehicle fees. State funds for 1921 total $3,738,420.

Delaware

Delaware had available last year $154,000 federal, $1,500,000 state, $1,600,000 county and $2,209,000 private funds, spending $154,000, $1,500,000, $513,000 and $660,000, respectively. Forty miles of state and 19 mi. of county roads were built during the season. Kent County passed a $1,000,000 bond issue and a $5,000,000 state bond issue is contemplated. Motor vehicle fees totaled $329,697. For 1921 $162,674 federal, $1,555,000 state and private, and $2,187,000 county funds are available. It is planned to construct 100 mi. of paved roads during the coming season.

Florida

Although the proposed $20,000,000 bond issue was defeated in Florida at the November election, the state and counties are doing considerable road work. Several counties have voted bond issues amounting to about $2,000,000.

Georgia

Last year Georgia had $7,000,000 federal $2,000,000 state and $1,500,000 county funds available, spending $2,402,911, $2,000,000 and $1,321,292, respectively. Contracts were let for 965 mi. of earth and 206 mi. of paved roads, of which have been completed 45 mi. and 25 mi. A $40,000,000 state bond issue is contemplated. Motor vehicle fees totaled $2,000,000 last year. For 1921 approximately $2,000,000 state funds will be available.

Idaho

The State of Idaho in 1920 had $3,500,000 federal, $2,000,000 state and $15,000,000 county funds available, spending respectively, $3,500,000, $1,800,000 and $3,700,000 with 655 mi. of earth and gravel, and 40 mi. of other roads under contract. Last year a state bond issue of $2,000,000 and about $5,000,000 of county bonds were voted. For the coming season it is estimated that $1,000,000 of state and $6,000,000 of county funds will be available, with a program for improving 350 mi. of earth and gravel and 50 mi. of other roads.

Illinois

The State of Illinois has a $60,000,000 state road bond issue which has not yet been marketed. During 1920, 341 mi. of hard-surfaced roads were completed, with 190 mi. carried over to 1921. Contracts have been awarded for 81 bridges and 135 mi. of grading, of which 30 bridges and 57 mi. of grading have been completed. A total of $5,915,646 motor vehicle fees was collected last year.

Indiana

Indiana last year had $2,742,271 federal and $4,000,000 state funds available, spending $2,200,901 of federal and state funds in the construction of 51 mi. of federal aid roads. Approximately $1,800,000 in motor fees was collected. Federal and state funds available for 1921 total $7,500,000 and the construction of 200 mi. of paved roads is planned.

Iowa

Last year Iowa had available $7,800,000 federal, $6,879,100 state and $14,000,000 county road funds, spending respectively, $1,000,000, $4,000,000 and $14,000,000. About 459 mi. of federal and state roads were built and $7,500,000 in motor fees collected. In 1921 it is planned to build 500 mi. of earth and 150 mi. of paved roads, with $6,800,000 federal, $10,000,000 state and $15,000,000 county funds available.

Kansas

Counties in Kansas in 1920 had $12,643,502 available for road work, exclusive of federal aid or other special highway work. In 1919 and 1920 contracts were let for 357.88 mi. of road, of which 267 mi. were uncompleted at the close of the past season. These contracts involve a total of $9,574,829 of which $3,681,598 is federal aid funds. In November the state road law was amended so as to permit the state to aid counties in building roads.

Kentucky

Contracts involving $1,800,000 federal, $2,300,000 state and $100,000 county funds were let by Kentucky last year. Sixty-two miles of federal aid roads were completed during the season. County bond issues totaling $500,000 are contemplated and the Louisville Automobile Club is agitating a $50,000,000 state bond issue. During 1920 bond issues passed by counties totaled approximately $50,000. In 1921 there will be $1,900,000 federal and $2,700,000 state funds available, with a program calling for the construction of 100 mi. of earth and 50 mi. of paved roads.

Louisiana

For the year ending April 20, 1920 approximately $1,293,385 federal, $195,570 state and $3,006,882 parish funds were available for highway improvement. During the two years ending April 20, 1920, about 505 mi. of gravel road were contracted for, of which about half has been completed. Motor vehicle fees for the last fiscal year amounted to $291,137. Bonds to the amount of $14,204,500 were issued by the parishes during the two years ending April 20, 1920.

Maine

Maine had $1,000,000 federal, $2,000,000 state and $600,000 of town funds available for highway work in 1920, expending $400,000 federal, $1,700,000 state and $550,000 town funds. About 180 mi. of gravel and 30 mi. of paved roads were built. Motor vehicle fees totaled $820,000. For the present year $1,000,000 federal, $2,000,000 state and $650,000 town funds are available and it is planned to build 200 mi. of gravel and 100 mi. of paved roads.

Maryland

In 1920 Maryland had $850,000 federal and $2,350,000 state funds for highay work, spending $728,268 federal and $1,492,750 state funds. A total of 83 mi. of federal and 51 mi. of state aid roads were constructed. Motor vehicle fees totaled $1,949,309. For the present year $850,000 federal and $2,350,000 state funds are available, with a program calling for the building of 110 mi. of paved roads.

Massachusetts

The Commonwealth of Massachusetts had $1,400,078 federal and $7,538,000 state funds available in 1920, spending $5,000,000 thereof. Five miles of earth and 116 mi. of paved roads were built during last season. Motor vehicle fees amounted to $3,860,231. Funds available for highway work during the coming season consists of $1,472,788 federal and $7,000,000 (estimated) state funds.

Michigan

The State of Michigan had $4,050,000 federal, $9,000,000 state and $15,000,000 county funds available for highway work in 1920 and spent $1,500,000 federal and $5,500,000 state funds during that period. Information of county expenditures is not complete. About 75 mi. of federal, 243 mi. of state and 458 mi. of county roads were built. Motor vehicle fees collected amounted to $5,482,853. Funds available for road work in 1921 include $2,811,000 of federal funds, plus the balance from last year, $7,500,000 of state and $25,000,000 of county funds, the latter of which includes many special assessment bonds which it was impossible to market during the past season. The 1921 program calls for the construction of 600 mi. of state and 900 mi. of county roads.

Minnesota

In Minnesota last year there were available for highway work $6,851,887 federal, $2,370,000 state and $25,000,000 county funds, of which $2,000,000 federal, $2,200,000 state and $10,000,000 county funds were expended. Counties passed $5,000,000 of bond issues and the voting of a similar amount is contemplated. A total of 1,366 mi. earth and 98 mi. of paved roads were under contract. For the present season $3,500,000 federal, $8,000,000 state and $15,500,000 county funds will be available, with a program calling for the construction of 1,800 mi. of earth and 100 mi. of paved roads.

Mississippi

The Mississippi State Highway Department has no jurisdiction over road work except federal aid projects. However, it is estimated that there was approximately $5,000,000 expended on road work in that state in 1920 and that the same amount will be available this year. In 1920 the Legislature passed a law making available for road purposes about $500,000 a year from a motor vehicle tax.

Missouri

Up to November, 1920, the State of Missouri had 1,931 mi. of road under construction, at a total estimated cost of $20,202,000. In November a state bond issue of $60,000,000 was authorized by the voters of the state and plans are being laid for the construction of a state system of improved highways.

Montana

Last season the State of Montana had $3,491,837 federal, $626,400 state and $7,255,000 county funds available and spent $1,440,000, $626,400 and $1,500,000, respectively. About 250 mi. of earth and 19 mi. of paved roads were built. Counties passed bonds amounting to $775,000 and motor fees totaled $486,000. For work during the present year $3,925,000 federal, $625,000 state and $5,395,000 county funds are available. The program includes the construction of 480 mi. of earth and 25 mi. of paved roads.

Nebraska

For the years 1917 and 1918 the State of Nebraska had $1,279,757 available, and for the years 1919 and 1920, $6,186,524, making for the four years a total of $7,466,281 available. Of this amount $3,724,541 has been expended, leaving a balance of nearly $4,000,000. The 1921 apropriation by the state will be $2,000,000. In addition, there will be $2,000,000 federal aid funds, making an additional $4,000,000 available. Several thousand earth and gravel roads have been placed under contract for improvement in 1920 and 1921. Nearly 50 mi. of concrete roads were built in 1920.

Nevada

The Department of Highways of the State of Nevada has not yet completed its compilation of work done during the past year, County bond issues of last year total approximately $1,200,000.

New Hampshire

New Hampshire had $414,838 federal, $940,000 state, and $800,000 town funds available in 1920, spending $261,000, $865,000 and $635,000, respectively. Approximately $100,000 of town bonds was voted last year. Three miles of earth and 97 mi. of paved roads were built. Motor vehicle fees amounted to $565,000. The program and the amount of funds available for 1921 are not yet known.

New Jersey

For the year ending June 30, 1920, New Jersey had $2,077,742 federal, $9,614,665 state and $8,000,000 county funds available, expending during that period $332,774 federal and $7,414,882 state funds, the amount spent by the counties not being known. About 57 mi. of paved roads were built and $3,298,731 collected in motor fees during the fiscal year. For the year ending June 30, 1921, state funds available total $7,651,998 and the program calls for the paving of 66.53 mi. of road.

New Mexico

With $1,500,000 federal, $1,700,000 state and $500,000 county funds available last year, New Mexico spent $500,000, $1,700,000 and $500,000 respectively, with contracts on 1,500 mi. of earth and 300 mi. of gravel roads. Counties passed a total of $275,000 in bond issues and $2,000,000 state and $275,000 of county bond issues are contemplated. Motor vehicle fees amounted to $179,000. For the coming season $1,600,000 federal, $1,800,000 state and $600,000 of county funds are available, with a program for improving 1,600 mi. of earth road and 700 mi. of gravel and crushed rock surfaced roads.

New York

The New York Legislature appropriated in 1920 aproximately $29,000,000 for highway construction and maintenance. Of this amount $10,000,000 is to come out of bonds authorized in 1912; $1,000,000 is to be used on the Hudson River Vehicular Tunnel, and $3,450,000 is to pay excess cost for the completion of work embraced in war contracts. For the greater part of last season New York did not award any contracts for new work, devoting its attention to the completion of unfinished contracts. However, the letting of contracts for new work has been resumed. The Hewitt Legislative Highway Committee has prepared plans for the completion of 11,119 mi. of road, of which 10,380 mi. were authorized in 1917 and more than 8,000 have been built, since or prior to that time. Funds for this work are available from the $10,000,000 of 1912 bonds.

North Carolina

In December, 1920, North Caroilna had 70 federal aid projects under construction at an estimated cost of $9,156,420; 12 federal aid projects under contract at an estimated cost of $1,165,565, and 24 completed federal aid contracts costing $1,529,595. Approximately 150 mi. of earth and 50 mi. of paved roads were built last season and it is expected that 300 mi. of earth and 150 mi. of paved roads will be built during the coming season.

North Dakota

In 1920 North Dakota had available $1,500,000 federal, $300,000 state and $3,200,000 county funds. About $860,000 federal, $50,000 state and $810,000 county funds were expended. Approximately 184 mi. of earth roads were built. A $10,000,000 state bond issue is contemplated. Motor vehicle fees collected during the year were $691,202. For 1921 about $3,362,000 federal, $500,000 state and $3,000,000 county funds are available, with the construction of 800 mi. of earth roads planned.

Ohio

Although Ohio planned to construct about 700 mi. of gravel, concrete and macadam roads in 1920, considerable difficulty was experienced because the Ohio Supreme Court ruled that the interest rates on road bonds could not be increased. Accordingly, several million dollars of contracts have been carried over to the present year for completion.

Oklahoma

Oklahoma had in 1920 approximately $6,350,000 federal, $50,000 (administration) state and $2,000,000 county funds available, with contracts on 1,000 mi. of earth and 49 mi. of paved roads. County road bond issues passed during the year totaled $6,000,000. Motor vehicle fees collected amounted to $2,400,000. For the present year $5,350,000 federal, $2,000,000 state (estimated) and $10,000,000 county funds will be available, with a program calling for improvement of 2,000 mi. of earth and 500 mi. of paved road.

Oregon

In Oregon last year there were available $4,000,000 federal, $25,000,000 state and $12,000,000 county funds, of which were expended $1,096,000, $12,000,000 and $12,000,000. Many counties were unable to market their bonds. The state constructed 449.2 mi. of earth, 269.9 mi. macadam and 183.3 mi. of other roads. Counties had under contract 350 mi. of grading, 358 mi. of macadam and 22 mi. of other paving. A state bond issue of $25,000,000 and county bond issues totaling $3,370,000 were passed. Moing concrete foundations with concrete, bituminous or for 1921 consist of $3,011,299 federal, $19,633,210 state and $12,000,000 county funds.

Pennsylvania

The Pennsylvania State Highway Department in 1920 constructed 414.58 mi. of paved highways, having concrete foundations with concrete, bituminous or brick wearing surfaces. York County passed a $2,500,000 bond issue and Susquehanna County a $1,500,000 bond issue. In 1918 a state bond issue of $50,000,000 was authorized. A total of $12,000,000 of these bonds was issued in 1919 and the same amount in 1920. In 1920 motor vehicle fees were $8,090,181. It is estimated that $20,000,000 will be available in 1921 and that 350 mi. of paving will be under way early in the season.

Rhode Island

Rhode Island had $531,000 federal and $1,258,000 state funds available last year, spending $287,500 federal and $1,503,500 state funds. Forty-five miles of paved road were built during the season. A state bridge bond issue of $5,000,000 was passed and about $555,000 collected in motor fees. The 1921 program calls for the construction of 20 mi. of

(Continued on page 40)

Researches Leading to the Adequate Design of Roads for Heavy Motor Trucks—II*

By A. T. GOLDBECK†

(Continued from January 19)

2. A Determination of the Distribution of Forces Through the Wearing Surface and Underlying Subgrade

Having determined what forces are exerted on the road, the next logical step in our efforts toward the development of rational design leads us to an effort to find out how the surfacing and subgrade are stressed under these loads. These are research problems for the future and they present many experimental difficulties. At the present time we are able to determine stress distribution under static loads and we can also determine distribution of pressure on the subgrade, and both of these investigations should be made. It would be well to work toward the development of apparatus for measuring deformation under impact and also apparatus for measuring subgrade pressure under impact.

2. (a). An investigation of the Behavior of the Road Surface and Subgrade Materials under Action of Forces.—In any type of structure we must know how stresses are distributed when that structure is subjected to external forces before we can hope to rationally design the structure. When we consider that the road slab is supported by the subgrade in a non-uniform and continually varying manner, and when it is considered that if the slab were subjected to static loads alone the difficulties would still be enormous, how much more difficult must be the the problem before us when we attempt to consider impact? However, rational design should be our goal of the future and an effort should be made to measure the stress distribution in the slab under the various loading conditions to which it is subjected, including not only traffic loads but the loads produced by natural forces. Again we must not neglect the stress due to impact, and suitable means must be devised for obtaining the stress distribution under the action of suddenly applied forces.

2 (b). Pressure Distributed to the Subgrade.—A matter about which there is comparatively little knowledge is that of just how heavy truck loads are distributed to underlying subgrades. It goes without saying that if we hope ever to reach the stage of rational design we must be able to say definitely something of the law of distribution of concentrated loads to the underlying subgrade. Very little actual research has been performed on the distribution of pressure through materials, primarily because of the extreme difficulty of performing investigations of this character. A few results have been obtained, however, showing how concentrated loads are distributed through a concrete slab to the subgrade and it is felt that we now at least have an apparatus that is satisfactory for that purpose. It would seem that a very important research would be that of determining the distribution of pressure intensity between the subgrade and the road slab under the action of heavy loads on the slab. The slabs should be of sufficient range in thickness and design and the subgrade should vary in its characteristics. Such an investigation should also be made when the slab is subjected to impact. Unfortunately, however, there is now no available apparatus for determining subgrade pressure under impact, although it should be possible to devise such an apparatus.

3. The Effect of Forces on the Road Structure

(a) We have seen that roads are subjected to impact. Then why is it not a logical procedure to subject road surfaces of different design to about the heaviest impact that is to be expected from actual motor trucks? That is the plan now being followed out in a large series of tests in which a number of variations of design are being used. The specimens are being subjected to the impact of a special impact machine designed to give the same impact given by the rear wheel of a 5-ton truck. By careful observation, the results of impact tests of this character and the relative load supporting value of various types of pavements are secured and, moreover, such tests can be made when the road surfaces are supported on subgrades of varying supporting capacity. From the results of the tests thus far completed it has been observed that there are astounding differences in the resistance to impact of slabs of different design. Such experiments should be carried out on a sufficiently wide range of subgrades and should be followed by experimental stretches of road subjected to actual traffic so as to tie in the results of the impact test with actual traffic conditions. It is planned to accomplish this by subjecting actual roads to impact through the use of an impact machine mounted on a motor truck.

(b.) Investigations of the Subgrade Material.—General observation leads us to the belief that low bearing value in the subgrade greatly decreases the load carrying capacity of the road structure. The question naturally arises, then: What characteristics do soils possess which render them of high or low bearing value? And further, what steps must be

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Traffic Counts in Various States—III[*]

Brief Descriptions of the Progress Made in Traffic Censuses in the Several States — Classifications Adopted — Results

By A. N. JOHNSON[†]

(Continued from January 19)

Minnesota

Traffic counts were made during 1912 to 1917 at 10 different points, in all. They were taken during the summer months, extending over a period of 3 to 8 consecutive days.

The classifications made were as follows: Automobiles, trucks, wagons and buggies.

The number of state and foreign cars was also noted, together with the number of passengers per car at some of the stations. During 1918-1919 traffic counts were extended to some 56 stations, the counts being made during the summer months, usually for a period of 6 days. The classification was the same as used in the earlier counts except that practically all stations reported the number of passengers per car.

In 1918 at some of the stations over 30% of the automobiles passing were foreign cars, averaging from 10 to 15%. In 1919 the percentage of foreign cars was slightly decreased although a number of stations reported an excess of 25%. In 1919 it was noted on one of the heavy traffic roads that motor vehicles were 80% of the total; in 1919, 99%. From the average of all traffic counts made it was found that in 1918 motor vehicles were 89% of the total, in 1919, 92%.

The traffic census has been used to gain some idea of the volume of traffic carried by the roads and to make a comparison of the traffic on the various roads.

The report of the State Highway Commission of 1918 and 1919, issued March 1, 1920, contains a tabular statement of the traffic counts.

Mississippi

Except in one or two instances, to get the approximate number of vehicles on a given piece of road per day, no traffic counts have been made.

Missouri

Except in a few isolated cases no traffic counts have been made.

Montana

A few traffic counts have been made. The instructions stated that counts were to be taken on four days from 8 a. m to 4 p. m., and four days from 4 p. m. to 12 midnight.

Three general classifications were made:

Automobiles, light and heavy; trucks, light and heavy; wagons, light and heavy.

A column was also provided to note the number of motorcycles and number of head of stock.

Nebraska

No traffic census has been undertaken by the State Highway Department.

Nevada

Three traffic counts, covering a period of one week each, were made during the latter part of October and the first part of November, in 1917 and 1920. Two counts were made at two stations in 1917 and at one station in 1920 at the same point on the road south of Reno where counts were taken in 1917.

Enumerations were made from 7 a. m to 9 p. m., the tally sheets showing the following classifications:

Horse-drawn vehicles: 1-horse, light vehicle; 1-horse, heavy vehicle; 2 or more horses, light vehicle; 2 or more horses, heavy vehicle.

Automobiles: Runabout; touring car; motor truck; motorcycle.

Miscellaneous.

The average daily traffic on the road south of Reno was given as follows:

	Horse-drawn	Automobiles	Trucks
1917	70	355	20
1920	42	547	45

New Hampshire

A traffic census was taken during 1918 at 57 observation stations upon trunk line roads. The counts were made for seven consecutive days during June, July, August and September.

The classification used was as follows:

Horse-drawn traffic: Horse without vehicle; 1-horse vehicle, light; 1-horse vehicle, heavy; 2-horse vehicle, light; 2-horse vehicle, heavy; 3-horse vehicle, heavy; 4-horse vehicle, heavy.

Motor traffic: Motorcycle, New Hampshire; motorcycle, foreign; 2-passenger car, N. H.; 2-passenger car, foreign; 3-passenger car, N. H.; 3-passenger car, foreign; 4-passenger car, N. H.; 4-passenger car, foreign; 5-passenger car, N. H.; 5-passenger car, foreign; 7-passenger car,N. H.; 7-passenger car, foreign; freight trucks; omnibus, etc.

At most of the stations it is to be noted that the foreign cars were considerably in excess of the cars registered locally, on some of the roads the foreign cars being five times as many and averaging between two and three times as many.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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PROVIDING FOR TRAFFIC DURING HIGHWAY IMPROVEMENT

The public's frequent complaints about the failure of highway officials to provide suitable detours during the progress of road improvement work is usually fully justified by the facts. It is seldom that even a fairly good detour is provided and the cases in which there is one that deserves the name of road are so rare as to be as worthy of special mention. As expressed in a recent paper by State Highway Engineer Hirst of Wisconsin, "a 'public-be-damned,'' policy has been quite generally practiced."

It stands to reason that a road that is worth improving is of sufficient importance to traffic to require an adequate detour to take care of the traffic during its improvement. This is easily demonstrated by considering the effect of a detour upon the traffic in any assumed case.

A road has but one function. That function is to accommodate traffic between points through which the road passes. The service the road gives, or the return it yields on the money invested for its construction and expended for its maintenance, is measured by the cost of transportation over it. The lower that cost is, the greater the return the road makes. This cost of transportation is governed by a number of factors which include the distance between points served, the grades and the kind and condition of the surface.

Assume that a 2-mi. section of a first class gravel road is closed to permit its improvement. A detour 3 mi. long, even if it has a surface equally as good as the road it replaces and has as favorable grades, necessitates a 50% increase in distance traveled. If the traffic using the detour consists of say 1,000 passenger automobiles and 200 motor trucks, the additional cost of traffic—calculated at the very conservative figure of 5 ct. per mile per vehicle—will amount to $60 daily. If the road is closed for two months, this will amount to a total cost of $3,600. But not only is the cost estimated very conservatively, but actual conditions are seldom as favorable as those assumed. The character and condition of the surface of a detour are very seldom comparable with the old road and the grades are generally heavier. It is obvious, therefore, that the extra cost to traffic is frequently a heavy burden under the conditions that obtain in the ordinary case.

Highway authorities will not be rendering the maximum service to their employer—the public—until adequate detours are provided in those cases where a road cannot be improved without closing its entire width to traffic.

TRAFFIC CENSUS DATA

One of the most striking features of the reports on the methods of taking and recording traffic counts that are contained in the paper by A. N. Johnson, the third installment of which appears elsewhere in this issue, is the difficulty—if not impossibility—of comparing figures from different states.

This condition is natural enough, for the counts probably were made quite independently in almost all cases and were intended solely to provide specific information as to conditions on given roads. At the same time, if traffic census data are desired as a basis for designing—and certainly that is one of the principal reasons for a traffic count—it is evident that uniformity of method is needed.

In the matter of the classification of traffic, for instance, it is obviously of little use to attempt to compare a census in which the only division of passenger automobiles is into "5 or 7-passenger cars" and "2-passenger cars" with figures from a count in which there is a detailed classification by weight and number of passengers carried.

In like manner, the classification of trucks should be sufficiently detailed to provide against any possible misinterpretation of the data. Division into "light" and "heavy" trucks would not be sufficient, nor would the notation of the mere size of trucks. A given number of trucks of a specified capacity loaded with one commodity might have a far different effect upon a pavement than the same number of trucks of equal capacities carrying a totally different kind of freight.

To make the results of different traffic counts at all comparable, there should also be uniformity with respect to time—time of the year, time of the week and time of day. A census taken in summer cannot be compared with one taken in winter; one taken on Monday is not comparable with one taken on Saturday, and one taken from eight in the morning to six at night cannot be expected to yield results that can be studied in comparison with those obtained from one taken from noon to midnight.

The direction of traffic should also be taken into account, for the determination of width may well depend partly upon this factor.

The human equation, too, should be eliminated so far as possible. The ideas of no two observers are exactly alike and there are always many cases of wide divergencies in judgment as to weight and other factors.

There can be no doubt of the value of correctly obtained traffic data rightly used. But, like cost data, traffic information can easily be misapplied. One of the best safeguards against such misuse is uniformity in methods of securing and recording traffic in the taking of a census.

Highway Development in the United States

(Concluded from page 36)

paved roads and $244,000 federal and $969,000 state funds are available.

South Carolina

Out of $1,550,207 federal, $720,000 state and $14,000,000 county funds available in 1920, South Carolina spent $520,173 federal, $171,426 state and $906,986 county funds. Twenty-six miles of hard-surfaced and 336 mi. of earth roads were built. County bond issues voted during the year totaled $11,686,000. Motor vehicle fees amounted to $527,868. For 1921 there are available $2,424,475 federal, $720,000 state and $13,000,000 county funds. It is planned to build 350 mi. of earth and 50 mi. of paved roads during this year.

South Dakota

South Dakota has a $6,000,000 bond issue which has not yet been marketed. For the year ending June 30, 1920, a total of $757,384 of federal and state funds was expended. Several hundred miles of federal and state aid gravel and earth roads are under contract, with approximately $8,000,000 of federal and state funds available. For the first six months of 1920 motor vehicle fees amounted to $720,490.

Tennessee

Tennessee spent $3,061,189 federal, $1,020,396 state and $2,040,793 county funds in 1920, having under contract 247.69 mi. of hard-surfaced roads. Counties passed approximately $2,500,000 of bond issues and about $3,000,000 of county bond issues are contemplated. Motor vehicle fees collected amounted to $1,215,776. A total of $8,000,000 of federal, state and county funds are available for use in the present year and approximately 350 mi. of hard-surfaced roads are included in the 1921 program.

Texas

Texas had available last year $16,100,000 federal, $3,500,000 state and $80,000,000 county (bonds) funds, spending $2,484,000, $1,318,000 and $40,000,000 (estimated,) respectively. Approximately 110 mi. of earth and 867 mi. of paved roads were built. For the present year there are $13,616,000, federal, $3,000,000 (estimated) state and $60,000,000 (estimated) county funds available. It is planned to build 344 mi. of earth and 2,760 mi. of paved roads during the present year.

Utah

Although the State of Utah has not yet compiled figures for highway expenditures for 1920, it is estimated that about $5,000,000 was expended on highway work during the year.

Vermont

In 1920 Vermont had available $1,242,000 federal and $1,265,527 state funds, spending $326,037 federal funds. The amount of state funds spent has not been compiled. The revenue from motor fees totaled $555,384. Since the Legislature meets this month, the amount of funds to be available for the present year is not known.

Virginia

In November the voters of Virginia ratified an amendment to the state constitution permitting the Legislature to issue $50,000,000 of road bonds for highway improvement. It is planned to issue these bonds during the next five or six years for the building of a state highway system. The proceeds from these bonds, together with funds available from other sources, will make available approximately $80,000,000 during the next few years.

Washington

A $30,000,000 state road bond issue was defeated in Washington at the November election. However, it is estimated that about $5,000,000 state and $10,000,000 road and bridge funds will be available for 1921. It is also expected that the Legislature will appropriate an additional $2,000,000 for highway improvement and that motor vehicle fees will be about $4,000,000 in 1921.

West Virginia

With $2,900,000 federal, $1,000,000 state and $13,000,000 county funds available last year, West Virginia spent $1,300,000, $600,000 and $7,000,000, respectively, building 250 mi. of earth and 120 mi. of paved roads. A $50,000,000 state bond issue was authorized by the voters at the November election. Counties voted approximately $5,000,000 of bond issues and about $1,000,000 was received from motor vehicle fees. For 1921 there are $1,900,000 federal, $600,000 state, which may be increased by the Legislature, and $6,000,000 county funds available for highway work.

Wisconsin

Wisconsin had 623 mi. of earth and 838 mi. of gravel roads under contract last year. In the years 1919 and 1920 county bond issues totaling $36,000,000 were voted. Motor vehicle fees collected in 1920 amount to $3,116,220. For 1921 there will be available $3,500,000 federal, $10,000,000 state and $13,000,000 county funds.

Wyoming

A total of $4,897,711 of federal, state and county funds were available in Wyoming last year, of which amount $1,974,00 was expended, with 950 mi. of earth and 5 mi. of other roads under contract. Motor fees totaled $267,000 and a state road bond issue of $1,800,000 is contemplated.

Researches Leading to the Adequate Design of Roads for Heavy Motor Trucks—II

(Continued from page 37)

taken to improve the bearing value of the subgrade? It becomes necessary to make laboratory tests on soils to determine the physical characteristics which make them have low bearing value.

The following procedure is being carried out at the present time. Samples of soil are taken from the subgrade in the vicinity of places where the road has failed very badly. Similar samples are also taken from the same road where it has not failed under the same traffic. All of the supporting data are obtained in the field, giving complete information as to the topography and drainage. Samples of soil are then analyzed in the laboratory, determinations being made of their physical characteristics, including mechanical analysis, percentage of clay, silt, colloidal content, and bearing value when the soils are saturated and when they are in various stages of saturation. In this way it is hoped to establish what are the physical characteristics of soils making for good or bad support.

The question of how to improve the bearing value of soils should likewise be investigated. No laboratory tests are needed to prove that high water content in soils makes for low bearing value and it goes without saying that if we could properly eliminate water from the subgrade we would always have adequate support for our roads. Investigations should, therefore, be made on drainage with a view to establishing means for adequately draining subgrades composed of various kinds of materials and under all conditions of topography.

The field of research to be covered for the rational design of roads to successfully carry heavy traffic under all conditions has many ramifications and can be treated only in a very general way. The following table, however, gives a list of the researches, information from which should lead to the actual design of our roads:

RESEARCHES LEADING TO THE ADEQUATE DESIGN OF ROADS FOR HEAVY MOTOR TRUCKS

1. Determination of Static Forces and Impacts of Motor Trucks on Roads including the effect of:
   - (a) Sprung and unsprung weight distribution.
   - (b) Tires and cushion wheels.
   - (c) Springs.
   - (d) Speed.
   - (e) Kind and degree of roughness of road.
2. Determination of the Distribution of Static Force and Impact Through the Road Surface and Subgrade, including effect of:
   - A Surface
     - (a) Load.
     - (b) Variations in Materials (bituminous, concrete, brick, etc.)
     - (c) Variations in design (Rigid slab vs. non-rigid type) (Reinforced vs. plain concrete)
     - (d) Variations in thickness, etc.
     - (e) Variations in subgrade.
   - B Subgrade
     - (a) Variations in wearing surface.
     - (b) Variations in load.
     - (c) Variations in physical characteristics.
     - (d) Variations in moisture.
3. Investigations of Road Surface and Subgrade Materials.

   Note: This includes researches of the physical and chemical characteristics of materials and their combinations to determine their suitability and to establish such physical constants as may be needed in design.

The above researches are deemed necessary in order to place the design of roads on a rational basis, and it is possible to carry out such a program in the shortest possible time only through the coordination of all the agencies of the country capable of performing such work.

Accelerated Tests

In the meantime we are building roads and we want information very badly that will tell, not how to arrive at the design of a road rationally, but that will tell us with reasonable accuracy whether our road is going to prove adequate for the traffic. We should pursue our long series of tests to establish the fundamentals of road design, but we want approximate information immediately on what to expect of various designs. That is the reason for accelerated tests on actual roads. Such tests are not absolute, but they do give us much needed information quickly and they point to certain limitations in the various designs. Among such tests may be classed the impact tests of road slabs now being carried out by the Bureau of Public Roads and the accelerated wear tests in which different types of roads are subjected to the action of the same wearing device.

Indianapolis Plans Boulevard

Plans for a boulevard in Indianapolis, Ind., linking Riverside and Garfield, are being considered by the Board of Park Commissioners of that city. The improvement is estimated to cost $400,000.

Maryland To Sell Bonds

The State of Maryland has asked for bids on $2,500,000 worth of bonds, most of which are road bonds. Bids will be opened on Feb. 3 and the bonds will be delivered on Feb. 15. All of the bonds will bear 4½% interest.

New Jersey Plans Snow Removal

The New Jersey State Highway Department has purchased 75 motor truck snowplows and assigned them to various parts of the state in order to keep the main road open to traffic during this winter. The state has been divided into 24 sections and about 345 mi. of highway will be taken care of.

Road Work in Wentworth Couny, Ontario

A total of $137,207 was spent on road work in Wentworth County, Ontario, Canada, in 1920, according to the report of Thomas Allison, Road Superintendent.

In order to stimulate farmers to erect wire fences so as to help check the drifting of snow, the Wentworth County Council at its recent meeting adopted a measure providing that the county pay 30 ct. per. rod toward the cost of all wire fences erected along the roads.

Research Graduate Assistantships at University of Illinois

Sixteen research graduate assistantships, paying an annual stipend of $600, and leading to the Master of Science degree, are maintained at the University of Illinois, Urbana. These assistantships are open to graduates of American and foreign universities who are prepared to undertake for two years graduate study in engineering, physics or applied chemistry. Appointments are made during the spring and information concerning the assistantships may be secured from the Director, Engineering Experiment Station, University of Illinois, Urbana, Ill.

Governor Miller of New York Proposes Consolidation of Departments

The consolidation of the offices of State Engineer, Superintendent of Public Works and the Commissioner of Highways, is recommended by Governor Miller of New York in a message to the Legislature. The duties of these departments, it is pointed out, can be taken over by the State Engineer.

Secretaries of Four Northwestern States Urge Uniform Traffic Laws

The Secretaries of State of Montana, Idaho, Washington and Oregon recently met to discuss uniform traffic laws. Recommendations will be submitted by the secretaries of these states to the legislatures for the passage of uniform traffic laws. The secretaries attending the conference were, J. Grant Hinckle, Washington; Charles T. Stewart, Montana; Robert O. Jones, Idaho; Sam Kozer, Oregon.

Guilford County, North Carolina, Passes $2,000,000 Bond Issue

A road bond issue of $2,000,000 was recently passed by Guilford County, North Carolina. It was feared that considerable opposition would come from the rural sections because the county commissioners had previously refused to agree that half of the proceeds of the bond issue would be used for improving clay roads in the country. However, officials of the County Farm Bureau supported the proposition.

Highway From Mainland to Key West Will Be Built

By the recent passage of a road bond issue of $400,000 by Monroe County, Florida, a highway from the mainland to Key West has been made possible.

The road will be 20 ft. wide with rock surfacing, 15 mi. in length, and will traverse the keys lying in the ocean. Only one trestle will be built, fills being made between all other keys. It is expected that this road will do much to develop the keys, both by making possible the building of homes and the transportation of produce. The road will also attract tourist traffic.

———ooo———

Monmouth County, New Jersey, will spend $440,000 next season in paving the road between Long Branch and Asbury Park.

The City Council of Akron, O., recently authorized a $200,000 bond issue to provide funds for resurfacing, repairing and improving streets in that city.

The City of Lorain, O., has prepared a paving program for 1921 involving an expenditure of about $250,000. The program includes the paving of 18 streets.

Will Mark Roads Traveled by Lincoln

Monumental posts will be erected on roads in 18 counties in Central Illinois to mark the roads traveled by Lincoln. The posts will be placed at the county lines by an organzation formed for the purpose, known as the Lincoln Marking Association.

Development of Alaska's Highways Planned

Congress will be asked to appropriate $955,000 for road work in Alaska in 1921, according to Col. J. G. Steese, of the Alaska Road Commission. An additional appropriation of $1,000,000 a year for ten years will also be asked to carry out the program of the commission, which provides for the improvement and construction of 4,000 mi. of through roads and trails and 2,500 mi. of short spurs.

"In the last year," said Col. Steese, "more or less work was done on about 4,000 mi. of wagon roads and winter sled trails. The appropriation under which we ran last year allowed us about $530,000 for actual construction.

"The men in charge and even the common laborers are largely long-time residents of Alaska. The support and encouragement found all over the territory is particularly gratifying. A united front should convince Congress of the need for substantial appropriations."

Col. Steese, who is now in Washington, D. C., expects to return to Alaska in February.

Highway Work Will Relieve Unemployment

American Automobile Association Official Says Road Building Will Stabilize Labor

"If unemployment assumes widespread proportions, the most logical answer to the situation would be the prompt utilizing of this excess labor in the building of highways possessing an interstate significance," says David Jameson, of the American Automobile Association.

"It will be remembered that when Congress was approached some two years ago for $200,000,000 additional under the provisions of the Federal Aid Act, it was set forth that this money, which called for an equal amount from the several states, would serve to absorb the surplus labor which it was anticipated would result from the termination of the war.

"But the period of non-employment did not arrive, besides which there was difficulty in obtaining materials and their shipment, which, together with high prices, cut down road construction. Present conditions, however, are such that the supply of labor in the near future may considerably exceed the demand, hence a recourse to important public improvements would be a direct means of stabilizing labor conditions."

Reduced Railroad Rates to A. R. B. A. Convention

A special round-trip rate of one and one-half times the one-way fare has been granted for the Chicago convention of the American Road Builders' Association by the Central and Western Passenger Associations and other passenger associations are expected to make like concessions.

These rates will be effective beginning Saturday, Feb. 5, and ending Wednesday, Feb. 16. Delegates must get certificates from ticket agents at point of departure and present them at the convention for vise.

Road Work in Ashland County, Wisconsin

Ashland County, Wisconsin, will spend $92,000 for road improvement in 1921, in addition to the money spent by the several towns not connected with the county highway system. Eight bridges will be built at an estimated cost of $40,000. An unexpended surplus of $54,000 will be used on federal aid work.

University of Michigan Fellowships in Highway Engineering Awarded

Candidates for Master's Degree to Carry on Important Studies of Highway Problems

Four fellowships in highway engineering and one in highway transport have been awarded by the University of Michigan. The men receiving these fellowships will be in residence during the winter period from December to March and will be candidates for the master's degree.

The Roy D. Chapin fellowship in highway transport is awarded to H. G. Smith, who since 1915 has been deputy chief engineer of the Oklahoma State Highway Department. Mr. Smith will investigate highway transport economics.

The Roy D. Chapin fellowship in highway engineering is awarded to R. R. Fauver, of Ohio Engineering Co., who will investigate economic aggregates for cement concrete pavements and structures.

The Detroit Edison fellowship in highway engineering is awarded to E. R. Olbich, of Pennsylvania State College, who will study dust preventives and surface preservatives for gravel roads.

The Detroit Edison second fellowship in highway engineering is awarded to Chia T. Yeh, sent to this country to study American road building methods. He will investigate the binding value of Michigan gravels.

The National Steel Fabric Company fellowship in highway engineering is awarded to H. T. Corson, Instructor in Surveying at Camp Davis, who will investigate the design of cement concrete pavements and foundations as structures.

Massachusetts Highway Association

OFFICERS FOR 1920

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Announcement

This section of the paper is open to members of the Massachusetts Highway Association for the discussion of matters directly connected with road interests. Members are requested to submit items of interest for use in this column.

Address all communications to GOOD ROADS, P. O. Box 2705, Boston.

The regular quarterly meeting of the Massachusetts Highway Association was held at Chipman Hall, Thursday, Jan. 13, about 140 members being present. President Blake called the meeting to order promptly at 7:30 and after a short welcome by Councillor James A. ("Jerry") Watson of Boston, moving pictures were shown.

The first picture was furnished by the Koehring Machine Company of Milwaukee, Wis. These pictures furnished very valuable information as to the construction of concrete roads from the very beginning, showing the scarifying and reshaping and rolling of the subgrade, up to the time the work is completed. While the pictures were being shown Mr. George A. Sherron, Eastern Manager of the Koehring Machine Company, spoke and explained to the members the reason why different things were being done to eliminate the high cost of road construction. After these pictures were shown, a very short discussion between Mr. Sherron and the members took place.

The next picture was furnished by the United States Rubber Company, showing the difference in pneumatic tires on heavy duty trucks and solid tires. The pictures were taken with a very slow exposure and clearly showed the difference in the two tires.

The next reel was furnished by the Barrett Company and showed the tar penetration method of road construction from the period in which the road was scarified and reshaped until the final application of the tar was completed.

The next reel was furnished by the Durax Paving Co. This reel showed a large block being taken from the quarry and reduced to 4-in. square blocks. Views were shown of Durax pavement filled with cement grout and with bituminous fillers.

Two applications were received for associate membership and a communication was read from E. L. Powers, informing the members of the coming convention of the American Road Builders' Association at Chicago, Feb. 9-12. There was also read a letter from the Merrill Estate Road Builders' Association, notifying the members to attend its three-day session early in March.

The Commissioner of motor vehicles of Connecticut is determined to enforce the regulations of his department to the letter. To this end, he has erected a building at the Massachusetts-Connecticut Line on the main thoroughfare between Springfield and Hartford, with inspectors on duty at all hours. This arrangement practically provides a dead line not to be passed by pleasure automobiles or trucks that do not conform in every respect with the Connecticut regulations.

First, to attract the attention of the motorists approaching the state line, is a huge signboard, 50 ft. long, across of which are the words, "State of Connecticut," in red letters. Underneath is printed a synopsis of the motor vehicle laws of the state plain enough to be read by anyone, day or night, as the board is illuminated by numerous electric lights after dark. The laws on the signboard follows:

Official Warning

Maximum weight of any vehicle, including load, limited to 20,000 lb. until May 1, 1921. Maximum width of any vehicle, including load, 4 ft. 6 in.

Headlights must have a device to prevent glare, which is approved by the commissioner of motor vehicles.

Reckless driving absolutely prohibited; speed at all times must be reasonable and proper; tail lights must show red; white tail lights prohibited; all accidents must be reported; proper lights required on all vehicles; all commercial motor vehicles must have a mirror properly adjusted; vehicles prohibited stopping abreast of each other on highways; metal-tired wheels on motor vehicles prohibited; vehicles approaching from the right at intersecting streets have a right of way; vehicles must not stop on curves in highways; arrests will be made for violations of the above.

For information address Commissioner of Motor Vehicles, State Capitol, Hartford.

Beside the sign is a comfortable little house in which an inspector of the Motor Vehicle Department will be on duty all the time to watch for breakers of the law. This building is equipped with telephone and electric lights, and on a pole opposite the house is a searchlight that will illuminate the highway for some distance by simply pressing a button whenever the inspector is called out at night to look over passing motor vehicles. The inspector also has a motorcycle for use in pursuit of motorists who try to get by when he signals them to stop.

As this highway is on the main route from Boston to New York there is much travel by motor truck here and the inspectors have been instructed to give special attention to these vehicles. The inspector even stops trucks on which the registration plate is so dirty that the numbers cannot be easily read and has the driver clean the plate.

The commissioner of motor vehicles says that there is no intention of persecuting motorists in Connecticut, but motorists who do not obey the laws of the state will be prosecuted.

Boston engineers, through the Boston chapter of the American Association of Engineers, have organized a civic committee, with J. B. Russell as chairman, to get in touch with all civic matters of an engineering nature and to lend their aid in safeguarding the public life and health. The first work of the committee will be in connection with the new maritime association fostered by the Boston Chamber of Commerce, which has expressed a willingness to cooperate with the engineers in the project. Much of the work of the maritime association will be of an engineering character, having to do with port development.

A bill for the licensing of engineers of the state has been prepared and a draft will be presented at the next monthly meeting of the chapter for discussion. This bill has been drawn up in conjunction with the Boston Society of Engineers.

The Committee on Constitutional Amendments of the Massachusetts Legislature recently voted to recommend the passage of a bill allowing towns with a population of 6,000 or more to have a limited town meeting. At present the law allows towns with a population of 12,000 or more to adopt the limited form of meeting.

On Jan. 7 the Supreme Court of Massachusetts dismissed a petition brought by the attorney general to oust the members of the city government of Methuen. The court found that there had been errors of organization in the process by which the town became a city and said that steps should be taken to remedy these errors, as could be done by the Legislature.

Mayor Quinn of Cambridge, who has just begun the second year of his second term has recommended in his inaugural that the unemployed be put to work on needed public improvements. He called attention to the proposed widening of Main Street and to the state law permitting municipal appropriations for war memorials.

The Massachusetts Supreme Court has rendered a decision of special interest to all automobilists, to the effect that the commonwealth is not liable for injuries to persons on the state highways during road construction.

The specific case in which the court decided against petitioners was that of Mr. and Mrs. Solomon Lemon, who declared that they were injured when the automobile in which they were riding collided with an unlighted iron horse in the Town of Spencer on the night of Sept. 11, 1917.

Automobile registrations for the United States for 1920 numbered 9,274,920, an increase over 1919 of 21.9%.

Registrations for the New England States are given below, together with the rank of each state and percentage of gain.
try.

	Rank	1920	% Gain
Massachusetts	11	314,631	27.3
Connecticut	24	119,037	16.2
Maine	36	63,300	18.5
Rhode Island	41	49,356	10.1
New Hampshire	44	34,700	9.7
Vermont	45	31,616	18.0

These registration figures show that there is now one motor vehicle for every 11.8 persons in the country.

Bills seeking appropriations to start construction of four bridges across the Charles River and $800,000 for a permanent drawbridge between Charlestown and Chelsea have been introduced in the Legislature by Mayor Peters of Boston.

The mayor seeks permission to borrow $800,000 to begin work on the Charlestown-Chelsea draw, which will replace the present temporary structure that has been in use for more than five years. The bill explains that either a new bridge must be erected or traffic between the two cities over this highway must be discontinued before long for safety.

Appropriations are asked for the construction of temporary bridges at Western Avenue bridge between Brighton and Cambridge; the River Street Cambridge bridge and the Cottage Farm bridge to handle traffic while permanent bridges are being constructed. Under the terms of the bill the state will start the work and the cities will pay later.

The first official act of Mayor William A. Bradford of Quincy was to accept the resignation of Commissioner of Public Works, H. A. Weaver and appoint to the position Moses L. Brown who filled this office during 1914, 1915, 1917, 1918 and 1919. The salary is $5,000 per annum.

It is with deep regret that we note the recent death of Charles J. Morse.

Mr. Morse was born in Lowell on Nov. 27, 1849. He was educated in the Lowell schools, including the Old Moody School and Burdett College. Afterwards he learned the trade of hardwood polisher, which followed in Lowell until 1872.

In that year he went to Pueblo, Colo., and prospected in that vicinity for about five years. Returning to Lowell in 1877, he was a fireman for two years and then became a policeman. He served in the Police Department a little over four years, becoming an inspector.

In October, 1886, he went west again, with three companions. After a short stop at Fort Dodge, Kan., they continued to Texas, where they spent the winter. After living for a short time near Fort Elliot, Mr. Morse started out prospecting once more and covered the whole southwestern region, including the states of New Mexico, Arizona and Texas. It was while he was in this section that he acquired the sobriquet, "Arizona Charlie," by which he was familiarly known to the last.

Returning to Lowell again in 1887, he took a position as letter-carrier and later foreman of the city paint shop. Two years later he was made foreman at the city ledge, retaining that position for nine years. The board of aldermen in 1905 elected him superintendent of streets, and he was subsequently reelected in 1906, 1907 and 1908. For several years thereafter his real estate interests occupied his attention.

In 1913 he was elected commissioner of streets, highways and sewers. He served continuously until Dec. 31, 1919. His last year of service was as head of the fire and water works department.

Last summer, with a party of friends, he took the trip west once more, covering as nearly as possible the route he traversed in 1872 and 1886.

Mr. Morse was married, Oct. 16, 1896, to Matilda McNabb, of Lowell. He leaves his wife and one brother, William G. Morse, both of Lowell.

Death came as a great surprise and shock to his relatives and many friends.

New York State Road Builders' Association

OFFICERS

JOHN H. GORDON, President,	Albany
C. J. HENDRICKSON, Vice President	Syracuse
WILLIAM G FOX, Treasurer	Saratoga
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FRED E ELLIS	Melrose, Mass.
W T. THAYER	Chateaugay
JOS McCORMICK	East Providence, R. I.
JOSEPH WALKER	Albany
S. B. VAN WAGENEN	Rondout

Legislative Committee

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JOS. McCORMICK	East Providence, R. I.
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J. F. PADDELFORD	Sherburne

Crusher Run

Governor Miller suggested in his message to the Legislature, that the Highway Law be amended to permit the use of available funds in excess of sums that can possibly be spent this year, for maintenance and reconstruction of highways, so as to make possible a reduction in the annual appropriation for such purpose. He also suggested that the motor vehicle tax be increased to provide all the revenue needed for highway maintenance.

Sephrine D. Gilbert, who has been auditor of the New York State Highway Commission since the Hughes administration in 1909, has resigned his position to take up his duties as one of the officers of the Northern New York Utilities Co., of Watertown, N. Y. Former Highway Commissioner John N. Carlisle is president of this company. Mr. Gilbert's resignation will take effect on Jan. 31, 1921.

Mr. Gilbert's resignation came as a great surprise. He had been retained under five administrations regardless of politics. He is a financial expert. Commissioner Greene in speaking of his resignation said that for years he had been the foundation upon which the intricate and large financial business of the department rested securely and that his leaving the department would prove a severe loss to the state.

In the letting taking place today at the New York State Highway Department, there are 20 roads advertised—15 concrete roads, 4 bituminous macadam and 1 water-bound road. Ten of these roads are federal aid roads. The roads are located in 15 counties.

The annual meeting of the New York State Road Builders' Association is being held at the rooms of the Association, Journal Building, Albany, N. Y., this afternoon.

Herbert S. Sisson, State Excise Commissioner, whose department will automatically cease existence this year under Governor Miller's economic program, has been appointed by the Governor as New York State Highway Commissioner, to succeed Frederick Stuart Greene.

Mr. Sisson, the new appointee, comes from the town of Collins just outside of Buffalo, in Erie County. He has served as excise commissioner since Jan. 25, 1917, when he was appointed by Governor Whitman. Previous to his entrance into state service, Mr. Sisson had served as superintendent of the poor in Erie County, for 6½ years, and Supervisor of his town for 5½ years.

Commissioner Greene's resignation will become effective Feb. 1, at which time it is expected Mr. Sisson will drop the now perfunctory duties of excise commissioner and begin the administration of the State Highway Department.

The following is a copy of the invitation sent out by the New York State Road Builders' Association for its annual banquet:

> You are invited to be the guest of the New York State Road Builders' Association, at an informal reception and dinner, to be tendered by the association to all road contractors engaged in work in New York State, on Wednesday evening, January 26th, 1921, at 6:00 p. m. at the Hampton Hotel, Albany, N. Y.
>
> The favor of an answer is requested.
>
> John H. Gordon,
> President.

New Hampshire Good Roads Association

OFFICERS FOR 1920

WINFRED M. CHAPLIN, President	Keene
WM. J. MORRISON, Secretry and Treasurer	Keene
HARRY L. SMITH, First Vice President	Lakeport
OZMAN W. FERNALD, Second Vice President	Berlin

Board of Directors

C. M. BROOKS	Keene
WILLIAM A. GROVER	Dover
H. W. SPAULDING	Manchester

Ovid Winslow, formerly Superintendent of Public Works at Nashua, New Hampshire and also President of the New Hampshire Good Roads Association has been elected to the House of Representatives from Ward 1, Nashua. Mr. Winslow has been appointed chairman of the Public Improvement Committee which includes 15 members of the House. This committee has many important duties to perform in connection with special highway work.

Governor Brown and his council met Jan. 10 for the first time.

The question of a toll bridge over the Connecticut River between Littleton, N. H., and Waterford, Vt., was one of the first to be considered.

In the closing days of the administration of Governor Clement of Vermont he approved the expenditure of an appropriation for the erection of the bridge, but his aproval was too late to permit any action being taken by Governor Bartlett.

The new Mayor of Portsmouth, F. W. Hartford, Editor of the "Portsmouth Herald and Chronicle" was inaugurated on Jan. 1.

The Board of Public Works organized with Thomas A. Ward, a wealthy citizen who has given land to the city for parks and playground purposes, chairman, and Clarence Smart, clerk. David R. Smith was reelected superintendent.

Governor Bartlett recently opened bids for the construction of the superstructure of the Piscataqua Memorial Bridge.

The lowest lump sum bid was $619,000 offered by the American Bridge Co.

Reductions for the omission of a sidewalk and constructing the lift span on the same plan as the others allow the commissioners $12,500 more to work with.

The Bethlehem Steel Bridge Corporation, of Bethlehem, Pa., bid $634,700, offering to take off from this figure $2,500 for the omission of one sidewalk and $700 for following the same plan on the lift as on the other spans.

No decision on the bids was given, Governor Bartlett stating that he would communicate by wire with Governor Milliken of Maine and Secretary of the Navy Josephus Daniels, and that after they had been consulted the commission would be in a position to announce the award of the contract.

This is the magnificent Maine and New Hampshire Memorial bridge to be erected over the Piscataqua River between Portsmouth, N. H., and Kittery, Me., at a cost of $2,000,000.

While the cost of the new structure is to be divided equally among the two states and the Federal Government, Maine will derive the most benefit from it. The great local advantage, however, is to go to Portsmouth, because it will form a free means of access for the towns of Maine in its vicinity into the New Hampshire metropolis to trade. The present bridge exacts a toll which seriously interferes with frequent shopping in Portsmouth by people from over the river.

One of the last acts of Governor Bartlett was to appoint a memorial bridge commission. The members are: Arthur G. Whittemore, of Dover; Maj. Reginald C. Stevenson, of Exeter; Capt. Ronald Hoyt, of Portsmouth; Maj. O. E. Cain, of Keene, and William B. Swartz, of Nashua.

On Dec. 18, Mayor Verette of Manchester issued a statement regarding the Amoskeag Bridge which is to be constructed over the Merrimac River at Manchester.

There is a serious need of the bridge and the failure of the city to let a contract is a matter of much local interest and unfavorable comment.

The Mayor justifies his unwillingness to pass the specifications as presented to him. In his published letter in which he states his position, he explains that the specifications are loosely drawn and only three small blue prints were submitted as working drawings.

The following are some of the recommendations offered by Governor Brown in hs inaugural: Higher fees for motor vehicles; limit on size of motor trucks using state roads; reforestation and water and power development; development of cooperative marketing; extension of terms of selectmen to three years; rejection of Kimball homestead gift to state; creation of legislative assistant; "mending or ending" of direct primary law; absent voters' law; scientific basis for state officials' salaries; creation of state house of correction; strictest economy in state expenses; resubmission of tax amendments to people; rigid liquor enforcement; short session and few new laws; investigation of automobile accidents.

He also made the following references to state highway matters:

"The improvement of the highways was begun in 1905. The purpose was to accommodate the light traffic of that time. The plan then adopted and since adhered to had regard to the quantity rather than the quality of construction, and although we have built more than 1,500 mi. of trunk line and state aid roads at a cost on the part of the state, includng upkeep, of $5,000,000, and improved them year by year, they are still light for the burden now imposed, and their maintenance is costly.

"It would seem to be a reasonable proposition that ultimately the highways, like the railways, should be paid for and supported by the traffic they bear, and it is believed the policy of the state may well be shaped with this end in view.

"It is, therefore, suggested that the price for permits to motor vehicles be raised to correspond with the recent advance in tax rate, that registration fees, especially those of trucks, be increased, and that adequate license fees be exacted for vehicles temporarily in the state.

"In this connection it may be added that heavily loaded trucks from Boston and other business centers outside of New Hampshire are very destructive to the highways in our southern counties. Considering the damage they cause, should not all trucks, foreign as well as domestic, if operated in this state, be limited as to size, weight and load?

"This plan offers, to be sure, only a minor source of revenue, but it can yield more than at present without distress, and in the end much more. It should, I venture to suggest, at once be made to return enough for upkeep and in due time sufficient for new construction as well. In this way it is believed the problem of highway costs may be solved with comparative ease.

"New Hampshire has achieved an unenviable notoriety for automobile accidents. In respect to one class, at least, it stands, so far as can be ascertained, at the head of the list among the states of the union. Manifestly there is fault in the law or its enforcement. It is for you in your discretion to amend the one or provide for the other, or both."

Traffic Counts in Various States—III

(Continued from page 38)

The results of the census are shown by diagrams in the state highway report of 1917-1918.

New York

Some traffic counts were made on the state highways in 1909, 1914 and 1916. A four-day census, from 8 a. m. to 8 p. m., was taken about the first of September in these years on practically all of the important highways of the state and instructions were issued August 2, 1920, for a similar census extending over a 12-hour period on one Saturday and one Sunday during August.

A total increase of traffic, from 1916 to 1919, of 115% was recorded.

The traffic of 1919 compared with 1909 shows increase of twenty times, although the horse-drawn traffic of 1919 was but 36% of that recorded in 1909. The increase in motor traffic from 1916 to 1919 was 148%, while the increase in the number of motor licenses during this same period was 77%. The conclusion drawn is that each car was making a greater road mileage.

The classification used was as follows: Automobiles, New York State, other states; light delivery trucks; all other trucks; 1-horse vehicles; 2-horse vehicles. No reduction of results to obtain the tonnage is indicated.

Oklahoma

No traffic counts have been undertaken except one or two days' observation on a particular stretch of road to determine whether the traffic was too heavy to justify a certain type of construction.

The classification made of the traffic was as follows: Heavy and light horse-drawn vehicles; pleasure motor vehicles, and trucks. No special forms on which to record the traffic were used.

(To be concluded)

The City of Mexico, Mo., recently passed a bond issue of $60,000 for road improvement.

The City of Mansfield, O., spent $416,528 on street work in 1920, according to Warren C. Statler, City Engineer.

Tompkins County, New York, recently appropriated $32,000 for road work. With a similar amount available from the state and about $12,000 which will be received as the county's share of state motor license funds, a total of $80,000 will be available for road work this year.

MEETINGS

Calendar of Coming Meetings

Jan. 25-27—Associated General Contractors of America.—Annual convention, New Orleans, La., Chicago, Ill.

Feb. 9-12—American Road Builders' Association.—Eighteenth Annual Convention, Eleventh American Good Roads Congress and Twelfth Good Roads Show under the auspices of the A. R. B. A., The Coliseum, Chicago, Ill. Secretary, E. L. Powers, 11 Waverly Place, New York, N. Y.

American Road Builders' Association

Manufacturers of road building machinery and materials and dealers in all manner of equipment and supplies used in the construction and maintenance of roads and streets are manifesting the keenest interest in the coming Twelfth Good Roads Show to be held under the auspices of the American Road Builders' Association at Chicago, Feb. 9-12. According to a recent announcement from the headquarters of the association in New York City, the following have already arranged for exhibition space:

American Association of Engineers, Chicago, Ill.; "The American City," New York, N. Y.; American Road Plane, Inc., Lowell, Ind.; Asphalt Association, New York, N. Y.; Austin Machinery Corp., Chicago, Ill.; Austin-Western Road Machinery Co., Chicago, Ill.; Autocar Co., Ardmore, Pa.

Ball Engine Co., Erie, Pa.; Barber Asphalt Paving Co., Philadelphia, Pa.; Barber-Greene Co., Aurora, Ill.; The Barrett Co., New York, N. Y.; Bitoslag Paving Co., New York, N. Y.; Burch Plow Works Co., Crestline, O.; John F. Byers Machine Co., Ravenna, O.

Carbic Manufacturing Co., Duluth, Minn.; Philip Carey Co., Cincinnati, O.; O. T. Carpentier & Co., Chicago, Ill.; Chicago Board of Local Improvements; Clark Tructractor Co., Buchanan, Mich.; Clydesdale Motor Truck Co., Chicago, Ill.; Conneaut Shovel Co., Conneaut, O.; F.D.Cummer & Son Co., Cleveland, O.

Davenport Locomotive Works, Daveport, Ia.; Domestic Engine & Pump Co., Shippensburg, Pa.; Dunn Wire-Cut Lug Brick Co., Conneaut, O.

East Iron & Machine Co., Lima, O.; Easton Car & Construction Co., New York, N. Y.; Elgin Sales Corp., New York, N. Y.; "Engineering & Contracting," Chicago, Ill.; "Engineering News-Record," New York, N. Y.

Fate-RootHeath Co., Plymouth, O. Federal; Motor Truck Co., Detroit, Mich.

"Good Roads," New York, N. Y.; Granite Paving Block Manufacturers' Assn., Boston, Mass.

Hadfield-Penfield Steel Co., Bucyrus, O.; Hastings Pavement Co., New York, N. Y.; Headley Good Roads Co., Philadelphia, Pa.; Heil Co., Milwaukee, Wis.; Hercules Gas Engine Co., Evansville, Ind.; Hercules Powder Co., Wilmington, Del.; Highway Trailer Co., Edgerton, Wis.; Holt Manufacturing Co., Peoria, Ill.

International Motor Co., New York, N. Y.

Jeffrey Manufacturing Co., Columbus, O.

Keuffel & Esser Co., Hoboken, N. J.; Kilbourne & Jacobs Manufacturing Co., Columbus, O.; Kinney Manufacturing Co., Boston, Mass.; Koppel Industrial Car & Equipment Co., Chicago, Ill.

Lakewood Engineering Co., Cleveland, O.; Littleford Bros., Cincinnati, O.

"Manufacturers Record," Baltimore, Md.; Master Truck Sales & Service Co., Chicago, Ill.; "Municipal & County Engineering," Chicago, Ill.

National Paving Brick Manufacturers' Assn., Cleveland, O.; National Steel Fabric Co., Pittsburgh, Pa.; Nelson Concrete Culvert Co., Pontiac, Ill.

Overland Crane Co., Hammond, Ind.

Pioneer Tractor Manufacturing Co., Winona, Minn.; Portland Cement Assn., Chicago, Ill.; "Public Works," New York, N. Y.

Sauerman Bros., Chicago, Ill.; Standard Oil Co., Chicago, Ill.

Thew Shovel Co., Lorain, O.; Titan Truck Co., Milwaukee, Wis.; Tower Motor Truck Co., Greenville, Mich.; Turbine Sewer Machine Co., Milwaukee, Wis.; W. S. Tyler Co., Cleveland, O.

U. S. Bureau of Public Roads, Washington, D. C.; Universal Concrete Bar Co., Chicago, Ill.

Ward La France Truck Corp., Elmira, N. Y.; Warren Bros. Co., Boston, Mass.; Western Wheeled Scraper Co., Aurora, Ill.; Geo. D. Whitcomb Co., Rochelle, Ill.; White Co., Cleveland, O.; Wiard Plow Co., Batavia, N. Y.; Wood Hydraulic Hoist & Body Co., Detroit, Mich

Tenth Annual Road School of the Wisconsin Highway Commission

The tenth annual road school of the Wisconsin Highway Commission will be held at Madison, Wis., on Jan. 31 and Feb. 1, 2, 3 and 4. The program, according to a preliminary announcement, will be grouped as follows:

Monday, Jan. 31: Forenoon, registration; afternoon, opening of the school; evening, moving pictures.

Tuesday, Feb. 1.—Maintenance Day: Forenoon, "Patrol Maintenance"; afternoon, "Patrol Administration"; evening, moving pictures.

Wednesday, Feb. 2—Contractors' and Construction Day: Forenoon, "Construction"; afternoon, "Contractual Relations"; evening, "Booster" meeting.

Thursday, Feb. 3—Administration Day: Forenoon, "County Organization"; afternoon, "Current Problems"; evening, annual dinner.

Friday, Feb. 4—County Highway Commissioners' Day: Forenoon, "Problems"; afternoon, "Legislation" and annual meeting.

Highway Engineering Conference of the University of Pennsylvania

The program of the highway engineering conference of the University of Pennsylvania has been prepared. This conference will follow a two weeks' short course in highway engineering at the university and will be held in cooperation with the U. S. Bureau of Public Roads, the State Highway Departments of Pennsylvania, Delaware, New Jersey and Maryland, and the Bureau of Surveys and the Bureau of Highways of the City of Philadelphia. The program of the conference, to be held Feb. 7-11 in the engineering building of the university, is as follows:

Monday morning, Feb. 7: Preliminary addresses, followed by paper on, "Salient Features in the Conduct of Surveys for Roads and Pavements," by W. R. Wolfinger, Assistant Construction Engineer, Pennsylvania. In the afternoon two papers will be presented, "Preparing Plans and Making Preliminary Inspections for Roadway Improvements," by Edward E. Reed, Assistant State Highway Engineer, New Jersey, and "The Proper Designs of Drainage Systems for Different Subgrade Conditions by Ditching, Tile Drains, French Drains and Sub-base Stones," by Maj. Harry D. Williar, Jr., Assistant Chief Engineer, Maryland.

On Tuesday morning, Feb. 8, two papers will be read, "The Systematic Preparation of Estimates from the Viewpoint of the Engineer and the Contractor," by W. W. Mack, Assistant Engineer, Delaware, and "Fundamental Principles in the Handling of Earthwork," by A. H. Sauerburn, Superintendent of Construction, Pennsylvania. In the afternoon three papers will be given: "Resurfacig and Surface Treating Macadam Roads," by T. J. Wasser, State Highway Engineer, New Jersey; "The Problem of General Maintenance on all Types of Pavements," by Geo.. H. Biles, Assistant Commissioner, Pennsylvania, and "Federal Aid Road Work," by T. H. MacDonald, Chief, U. S. Bureau of Public Roads.

"Fundamental Economic Considerations in Locating and Designing Highways," by E. W. James, Assistant Chief Engineer, U. S. Bureau of Public Roads, and "The Application of Loads, Traffic Intensity, Speed and Subgrade Conditions to the Design of Road Surfaces," by A. T. Goldbeck, Engineer of Tests, U. S. Bureau of Public Roads, will be presented on Wednesday morning, Feb. 9. The papers in the afternoon are: "The Application of Engineering Geology in Controlling the Quality of Road Building Aggregates," by H. S. Mattimore, Engineer of Tests, Pennsylvania; "Practical Features to be Observed in the Design and Construction of Highway Bridges," by A. F. Gordon, Senior Highway Bridge Engineer, U. S. Bureau of Public Roads; "The Construction of Concrete Roads—An Historical Review," by H. E. Hilts, Principal Assistant Engineer, Pennsylvania.

E. J. Wulff, Senior Highway Engineer, U. S. Bureau of Public Roads, on Thursday morning, Feb. 10, will present a paper on "The Construction of Penetration and Mixed Asphalt Macadam Roads," followed by a paper on "The Preparation and Use of Sheet Asphalt Surfacing," by Prevost Hubbard, Chemical Engineer, The Asphalt Association. The afternoon session will be devoted to "The Use of Bituminous Products in the Maintenance and Construction of Roads," by W. H. Fulweiler, Chemical Engineer, United Gas Improvement Co.; "The Production and Use of Asphaltic Products for Roads," by Prevost Hubbard; "The Construction of all Types of Bituminous Pavements—An Historical Review," by Julius Adler, Deputy Chief of Highways, Philadelphia.

On the morning of the last day of the conference, Feb. 11, B. H. Wait, District Engineer, Portland Cement Association, will present a paper on "Standard Recommended Practice for the Construction of Concrete Roads," and H. S. Mattimore, Engineer of Tests, Pennsylvania, will deliver a paper on "Laboratory Control of the Quality of Concrete in Roadways." In the afternoon the last session will be held with the following papers: "The Preparation of Foundations for Vitrified Brick Surfaces," by P. M. Tebbs, Engineer of Construction, Pennsylvania; "The Construction of Brick Surfaces for Roads and Streets," by William C. Perkins, Chief Engineer, Eastern Paving Brick Manufacturers' Association.

An informal dinner will be held on the evening of Feb. 11, with George S. Webster, Chief, Bureau of Surveys, Philadelphia, as toastmaster.

PERSONAL MENTION

Russell S. Wise has been appointed city engineer of Clifton, N. J.

S. J. Humes has resigned as engineer of King County, Washington.

Thomas F. Baxter has been elected president of the Holt Manufacturing Company.

George S. Witters has been appointed county engineer of Ida County, Iowa.

A. B. MacStay recently resigned as street cleaning commissioner of New York City.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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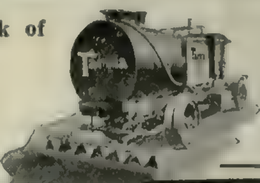

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Old Series, Vol. LX
New Series, Vol. XXI

JAMESTOWN, N. Y., FEBRUARY 2, 1921

Number
5

Paving on Chicago Streets

Considerations Governing the Design of City Pavements and Practice of the Chicago Engineers—Width—Crown and Crosswalks—Pavement Foundations — Cushion Courses — Wearing Surfaces of Various Types

By H. J. FIXMER*

The paving of streets in a large municipality requires broad experience and sound engineering judgment. In the city the value of the pavement to the users is of permanent importance. The pavement must prove safe and comfortable to use, must be truly economical, must present an agreeable appearance and must accommodate the abutting property and the character of traffic using it. We must consider not only the effect of the traffic on the pavement, but also the effect of the pavement surface on the user.

Since a pavement is judged by its surface, which is in common use and continuously in view, great care should be exercised to secure the best results.

A pavement must be designed to fit the needs of the traffic. There are five classes of traffic using the city street; namely, pedestrian, horse-drawn, motor, street railway and stationary traffic. Stationary traffic comprises vehicles loading and unloading merchandise, and vehicles, mostly motor, utilizing public space for parking. Since all classes of traffic have the right to use the street, the street must be designed to afford each class the maximum of comfort and safety without interfering with the rights of the other classes.

VIEW OF MICHIGAN BOULEVARD, CHICAGO, ILL., LOOKING NORTH FROM RANDOLPH STREET—SURFACED WITH SHEET ASPHALT

---

*Division Engineer, Board of Local Improvements, Chicago, Ill.

In the city street, where the width is fixed and permanently defined by buildings, the width of paved roadway and sidewalk must be carefully proportioned. Where this width is not adequate to accommodate the traffic the street must be widened by condemnation. This is being done in certain sections of Chicago, as rapidly as conditions will permit. Where this cannot be done, the accommodation of traffic becomes restricted and it then becomes necessary to regulate conditions by police power.

Width of Roadway

The width of roadway is established for each street by ordinance and is designed to accommodate the vehicle traffic, except where conditions such as inadequate street width necessitate balancing adequate width against the needs of the various classes of traffic.

A double track street railway requires the middle 20 ft. for safe operation. On streets other than those carrying car tracks the requirements of rapid traffic indicate a minimum of 20 ft. Since the side traffic is necessarily slow moving, a width of 8 ft. additional for each line of traffic and each line of parked vehicles (when parked parallel with the street axis) must be provided for. Where vehicles back against the curb in loading or unloading merchandise, or are parked in this fashion, at least 14 ft. must be allowed for each side. Were the length of vehicles regulated, this parking or loading width might be reduced to 12 ft. Thus a three-line traffic street should be 24 to 28 ft. wide, depending on the character of the street. A four-line traffic street should be from 36 to 48 ft. wide, depending on the nature of the traffic and use of the street.

Crown and Crosswalks

The crown should be as flat as is consistent with drainage and workmanship in order to promote safety and full use of the pavement. The old parabola form has been superseded by a modified curve which gives better drainage along the middle half of the roadway, and reduces the depth of gutter 25%. In connection with the development of a more satisfactory crown, considerable study has been given to the matter of securing greater comfort and safety for pedestrian traffic at all alley, street and private driveway crossings. This is secured by eliminating steps so far as advisable, avoiding gutter openings in the path of foot traffic, providing a smooth surface as level as practicable, and keeping the crossing clean and dry. On residence streets the usual step from the abutting sidewalk to the pavement surface has been eliminated at all crossings. On business or heavy traffic streets, considerations of safety and the greater importance of vehicle traffic modify the usual plan. On all street, alley and driveway crossings along this type of street, the pavement is built even with the sidewalk for a distance of at least 6 ft. nearest the building line. A step of from 5 to 6 in. is made at the curb adjoining the crosswalk crossing the busy street. By reason of eliminating the steps along the axis of the street the maximum pedestrian traffic is accommodated with little interference with the comfort and safety of the slow moving cross vehicle traffic. The step at the crosswalk crossing the busy street permits the pavement surface to be carried through on a nearly level grade, which accommodates the greater vehicle traffic. The presence of the step causes the pedestrian to hesitate before crossing the busy street. Where the street is of unusual width or carries a great volume of fast moving traffic a safety island is often built. Where two car lines intersect the usual step at the crosswalk is eliminated, since all vehicle traffic must slow down in crossing, and because the large amount of pedestrian traffic at this location demands a safe and comfortable crossing. Where a vehicle is traveling less than 15 mi. per hour, the slight raise in the pavement occasioned by the so-called "flush crosswalk" causes no inconvenience or jar to the traffic. By reason of paving the crossing even with the sidewalk with a low crown and slightly increasing the slope of the gutter away from the crosswalk, the crossing keeps clean and dry automatically. Where a step is necessary, a refinement worth while is to increase the gutter slope across the crosswalk to enable the gutter water to pass readily without depositing any refuse at the crossing.

To facilitate traffic, promote safety and add to the general appearance, the radius of the curb corners has been increased. On business streets and alley returns 6 ft. is the standard radius. On residence streets the radius is seldom less than 10 ft. Since the crown is reduced, the height of the curb above the gutter is also reduced, resulting in less curb breakage, neater appearance and less cost in grading. The "flush crosswalk" likewise removes all chance of curb breakage at the crosswalk, due to expansion of the abutting sidewalk.

Pavement Foundation

The typical pavement consists of four parts; the subgrade, the base, the cushion and the wearing surface. Motor-driven traffic, both pleasure and trucking, is the type of vehicle traffic we must design our pavements to meet. In some locations consideration must be given to the needs of horse-drawn traffic; but in general, the high types of surface warranted for motor traffic will prove satisfactory for the fast disappearing horse-drawn traffic. The subgrade and the base act as a unit foundation in supporting the pavement surface. In Chicago, experience has established the rigid concrete base as the most reliable. It will continue to be used exclusively for all types of pavement except macadam. Due to the location of underground utility structures with the frequent disturbance of the subgrade

ASHLAND AVENUE AND 12TH STREET—GRANITE BLOCK, WITH SHEET ASPHALT IN FOREGROUND

ROOSEVELT ROAD AFTER WIDENING, PAVED WITH GRANITE BLOCK

to effect connections or repairs, a self-sustaining base is almost universally required. Where the traffic is heavy and a multiplicity of substructures are present, the thickness of the base is proportionately increased above the minimum standard of 6 in.

Cushion

Where a rigid wearing surface is used, such as granite, sandstone or brick, a cushion of sand or screenings, varying from 1½ to 1 in. in depth, is used. Where a grout filler was used, a mortar cushion gave the best results. It is the opinion of the engineers of the Paving Bureau that better results will be secured by using a bituminous cushion, particularly in combination with a rigid base and rigid wearing surface. It is proposed to experiment with this type of cushion in the near future. It is proposed to mix the sand and bitumen, probably cut-back asphalt, on the job; spread the cushion, and then roll lightly before laying the blocks. The mixture will be mixed cold and contain about 4.5% of bituminous material. With creosoted wood block pavement, which is an elastic structure, the best results have been secured with a thin bituminous cushion on a smooth concrete base. The bituminous cushion is waterproof, absorbs considerable impact and keeps in place. Asphalt and bituminous macadam have elastic properties throughout the depth of the wearing surface, and, of course, require no cushion.

Wearing Surface

The wearing surface should be smooth. Comfort, safety and an agreeable appearance must be secured. To maintain a smooth surface a rigid, unyielding

(Continued on page 62)

IRVING PARK BOULEVARD—PAVED WITH WOOD BLOCK 56 FT. WIDE BETWEEN CURBS

FOSTER AVENUE, A TYPICAL RESIDENTIAL STREET—SHEET ASPHALT PAVEMENT

Highway Work in Illinois

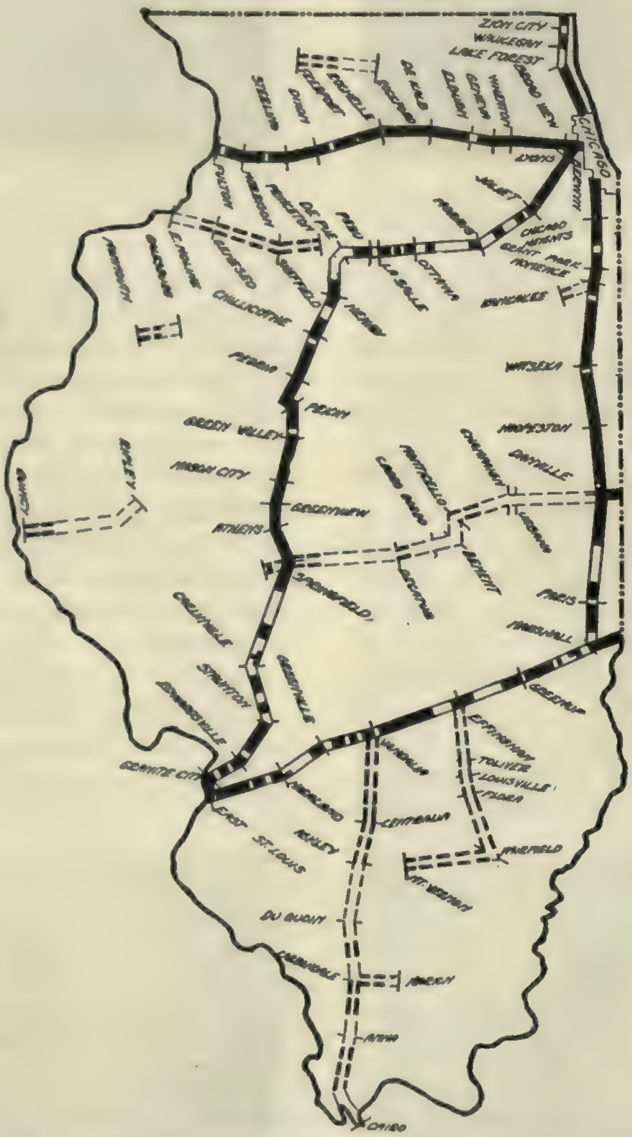
Approriations for Road Work — Bond Issues—Procedure Adopted in 1920—Work Accomplished—Status of Federal Aid Work—Maintenance

During the past four years the State of Illinois has made greater progress in highway development than in all the previous history of the state. Not only has the construction of durable roads been vigorously carried on, but the attitude of the people has changed and the desire for better roads has grown, thereby opening the way for improvement of not only the main roads of the state, but of all the roads in the state.

Following an appropriation of $1,326,000 by the 50th General Assembly in 1917 to meet the allotment to Illinois under the Post Roads Act, in 1918 the voters of the state ratified a $60,000,000 bond issue, the proceeds of which are to be used in the construction of hard-surfaced roads upon a system of approximately 4,800 mi. designated by the Legislature. [See GOOD ROADS, June 30, 1920.—Ed.] This was the largest bond issue for road improvement ever submitted by any state up to that time and was the first submitted in the Central West for the improvement of a state system of main highways.

The 51st General Assembly carried on the work begun by the 50th General Assembly in regard to federal aid, appropriating $14,500,000 to meet federal allotments of $12,000,000.

In 1919 the Governor of Illinois declined to proceed with the work of road building until satisfactory prices could be secured. Consequently, none of the $60,000,000 worth of road bonds have been issued. In 1920, when faced by prices greatly in excess of the average cost of 1919 contracts and also with a shortage of transportation facilities, which would greatly impede the work, it was decided to confine the letting of additional paving contracts to those sections where gaps existed on the federal aid system. The wisdom of this policy has been completely demonstrated by the conditions which have prevailed throughout the 1920 construction season. At the same time, however, it was decided to proceed with the letting of contracts for heavy grading and bridges where necessary, thereby doing this work a year or so in advance of building the road surface.



MAP SHOWING PROGRESS OF CONSTRUCTION ON FEDERAL AID ROADS IN ILLINOIS — FOR AN EXPLANATION OF SYMBOLS SEE FOLLOWING PAGE

During the years 1917 and 1918 the United States was at war and only the work under way could be finished, practically no new construction being permitted. And because of the conditions prevailing in 1919 and 1920, reasonable progress in road building was impossible. Nevertheless, during the past four years Illinois constructed over 750 mi. of hard-surfaced roads, as well as approximately 400 miles of graded roads were built during 1920, an amount greater than was ever built by any state prior to 1920, and more than was built by any state in 1920, with the exception of Pennsylvania, which had more mileage under contract. Approximately 190 mi. of uncompleted contracts have been carried over to 1921. In addition, contracts were awarded in 1920 for 81 bridges and 134.95 mi. of grading. Of these contracts, 30 bridges and 57 mi. of grading have been completed.

The completion of 341 mi. of paving was more than was anticipated by the Illinois State Highway Department, in view of the car shortage and the unfavorable rulings of the Interstate Commerce Commission. The efforts put forth by the department and the contractors would easily have built double

MATERIAL STORAGE PLANT AND TRACKS ON FEDERAL AID PROJECT NO. 1, LEE COUNTY

VIEW ON FEDERAL AID PROJECT NO. 1, LEE COUNTY, ILLINOIS — COMPLETED PAVEMENT

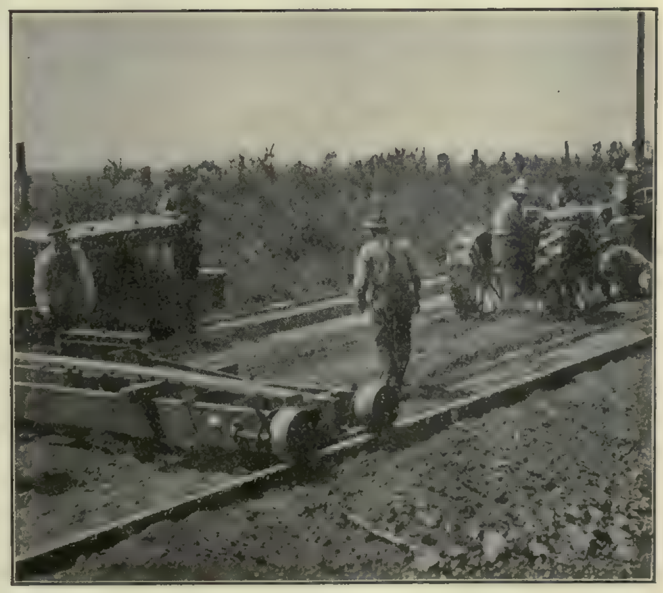
the mileage had conditions been favorable. At the beginning of the season there were 100 paving machines on the ground set up and waiting for materials to be delivered. Not more than 53 of these plants were in operation at any one time and the average through the season was considerably under that number.

The progress in construction on the federal aid system at the close of 1920 is shown in the accompanying map. The roads shown with unbroken narrow lines have pavement contracts let; roads shown with one unbroken thick line and one unbroken narrow line are roads with narrow pavements and on which have been let contracts for widening; roads shown in solid black have paving completed; roads shown in light broken lines are bond issue routes on which federal aid contracts have been let for all heavy grading and bridge work; roads shown in dark broken lines indicate the approximate location of heavy grading and bridge contracts. Although the map indicates that there are numerous gaps yet to complete on this system, many of the roads are now open to traffic and have sufficient mileage completed to be of service to the traveling public.

The matter of the cost of maintaining the roads of Illinois is of increasing interest to the people of that state, especially in view of proposed legislation. The accompanying table shows the mileage of roads maintained and the cost of maintaining the different types.

During 1920 a total of $5,915,646.17 motor vehicle

INDUSTRIAL RAILWAY IN OPERATION ON A ROAD JOB IN DEKALB COUNTY



SUBGRADER IN OPERATION ON FEDERAL AID WORK IN WHITESIDE COUNTY

SUPERELEVATED CURVE ON FEDERAL AID PROJECT NO. 2, KANKAKEE COUNTY, ILLINOIS

RECENTLY COMPLETED ROAD IN LEE COUUNTY, ILLINOIS — SHOWING WIDE SHOULDERS

funds were collected, 503,761 passenger cars and 64,997 motor trucks being registered. Because of the increasing numbers of motor vehicles on the highways, Illinois is now constructing a test road which is expected to be completed early in 1921. It is expected that this road will help in determining the service value of various pavements and will serve as a guide in regulating motor traffic.

MAINTENANCE COSTS 1919—ALL WIDTHS, 10 TO 18 FT.

Type	Miles	Wearing Surface		Upkeep Roadside.		Total Maintenance	
		Cost	Av. Cost per mile	Cost	Av. Cost per mile	Cost	Av. Cost per mile
Brick	86.90	$ 3,704.13	$ 42.63	$ 6,618.57	$76.16	$10,322.70	$118.79
Portland cement concrete	366.15	19,793.42	54.05	35,081.94	95.81	54,875.36	149.86
Bituminous concrete	19.43	4,745.94	244.75	230.77	11.88	4,976.71	256.13
Bituminous macadam	24.02	6,101.43	254.01	1,769.61	73.67	7,871.04	327.68
Water-bound macadam	26.95	8,070.32	299.45	952.73	35.35	9,023.05	334.80
Gravel	42.36	5,474.68	129.24	1,090.19	25.74	6,564.87	154.98
Oiled earth	133.50	8,460.51	63.37	2,820.33	21.13	11,280.84	84.50
Earth	280.75	21,529.11	76.69	4,382.56	15.61	25,911.67	92.30
Total	980.06	$77,879.54		$52,946.70		$130,826.24	

"It is evident," says S. E. Bradt, State Superintentent of Highways of Illinois, "that the trend of the times is toward lower costs of materials and labor, toward cheaper money and better transportation facilities. These factors should all be reflected in the cost of future road construction. Illinois with its sixty million dollar bond issue untouched is in an excellent position to take advantage of the situation which will be brought about by the above conditions. As indicated heretofore, during the 1920 season we have built 341 mi. of high type durable hard-surfaced roads. We believe that with this amount of construction accomplished in 1920, the conditions in 1921 will be sufficiently favorable to permit the building of at least 500 to 600 mi. of the same type of roads. Of the 4,800 mi. involved in the state bond issue system, 800 mi. have already been constructed or are under contract to be built from funds now available. With reasonable prices, ample supply of labor and improved transportation conditions, the remaining 4,000 mi. should be rapidly constructed. Not only will the work of placing a durable hard surface on the system be prosecuted as fast as conditions will permit in 1921, but in addition contracts will be awarded for grading and bridge work.

"The determining of the location of the bond issue roads is well under way and no doubt will be completed in the very near future. As rapidly as these locations are decided, plans and surveys will be made for the heavy grading and construction of the bridges. Where there are heavy cuts or fills, it is desirable that this work should be carried on a year in advance of the surfacing. With this out of the way, we can proceed with the work of surfacing the roads without unnecessary delay. This will bring about the completion of the entire system in a shorter space of time.

"It is generally conceded that Illinois, regardless of the handicaps with which we have been confronted, has made greater progress toward an adequate system of highways during the past few years than any other state."

Bridges in the City of Chicago

Number, Cost and Types of Bridges and their Operation — Traffic Conditions — Development of Bascule Type of Movable Bridge in the City—Description of Bridge on Michigan Avenue Improvement

The City of Chicago, second in the United States in point of population and perhaps the most typically American city in the country, is situated on the southwestern shore of Lake Michigan with a water front of 30 mi. Chicago lies at the central point of western and Great Lakes commerce and is one of the greatest commercial centers in the world, being connected by means of steamship and railroad lines with all parts of the country. A splendid harbor at the mouth of the Chicago River is formed by breakwaters. The city is divided into three sections, known as the North, South and West Sides, by the peculiar course of the Chicago River, over which have been erected many bridges.

Chicago maintains 49 movable and 28 fixed bridges, representing a first cost of over $24,000,000 and an annual expenditure of $500,000 for operation and $400,000 for repairs. Accordingly, the City of Chicago spends nearly $1,000,000 per year in keeping its bridges open to traffic.

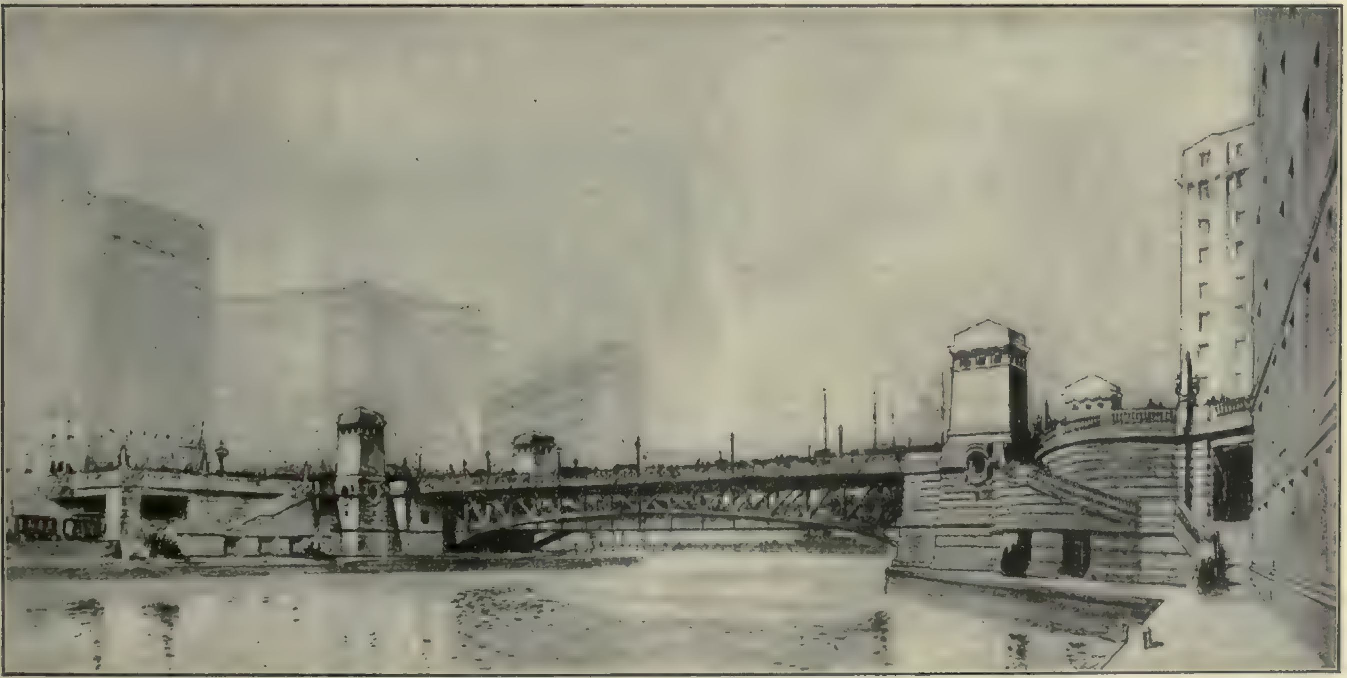
Naturally, in a city of such commercial importance as is Chicago, the problems of traffic are great. Before the improvement of Michigan Avenue, approximately 2,000 vehicles per day were delayed when moving east and west on South Water Street. Likewise was north and south bound traffic similarly delayed. An idea of the amount of traffic in the business sections of the city can be gained from a statement made several years ago by the chief engineer of the Illinois Central Railroad to the effect that the freight business originating in the Illinois Central yards just east of Michigan Avenue and south of the Chicago River amounted to approximately one-third of the entire business done by the whole Illinois Central System.

In order to better understand the bridge requirements of the city, a traffic census is taken each year on the more important bridges. These traffic counts have shown enormous increases in traffic from year to year. In fact, several of the present structures are now loaded to nearly their maximum capacity during the rush hours of the day. This is shown in the table of traffic during the rush hour from 5 to 6 p. m.

The traffic has been separated as shown, in order to show the decrease in horse-drawn traffic and the increase in motor traffic.

Table II shows the density of traffic during business and rush hours.

The first means of crossing the Chicago River was by a ferry which was started at Lake St. in 1829. Four years later a rough log bridge was erected at Randolph St. This remained in use for seven years. The first bridge over the North Branch of the river was built at Kinzie St. in 1832 and was of a floating type. Two years later the



THE MICHIGAN AVENUE DOUBLE DECK BASCULE BRIDGE RECENTLY OPENED TO TRAFFIC — MASONRY AND OTHER WORK IS TO BE COMPLETED NEXT JULY

BASCULE BRIDGE AT BELMONT AVENUE, CHICAGO—COMPLETED IN 1917

NORTHWESTERN AVENUE BASCULE BRIDGE, CHICAGO—LOOKING WEST

first movable bridge in Chicago was built at Dearborn St. Many good wooden swing bridges were subsequently erected, most of which were destroyed in the fire of 1871.

TABLE I—PRESENT BRIDGE TRAFFIC 5 TO 6 P. M.

Bridge	Date (1920)	Teams	Automobiles	Motor trucks	Street cars	Pedestrians
Michigan Ave.	Dec. 2	0	3,217	38	0	1,412
State St.	Dec. 6	112	534	83	145	1,554
Clark St.	Nov. 29	79	476	110	108	4,501
Wells St.	Dec. 10	7	58	21	105	523
Franklin-Orleans St.	Dec. 7	49	305	52	0	184
Lake St.	Dec. 8	168	164	160	252	864
Washington St.	Dec. 9	17	1,072	74	0	3,063
Madison St.	Dec. 13	105	176	82	185	6,683
Monroe St.	Dec. 14	75	223	69	14	5,553
Adams St.	Nov. 30	54	168	89	77	3,500
Jackson St.	Dec. 15	16	1,080	52	0	1,320
Van Buren St.	Dec. 1	106	30	92	88	778
Harrison St.	Dec. 16	116	31	83	15	325
Polk St.	Dec. 17	19	1	23	0	644

TABLE II—TRAFFIC DURING BUSINESS AND RUSH HOURS

Bridge	Total vehicles 5 to 6 p. m.	Total vehicles 7 a. m.—7 p. m.	Total Pedestrians 7 a. m.—7 p. m.
Michigan Ave.	3,255	23,716	8,185
State St.	874	7,945	13,287
Clark St.	773	7,008	22,026
Wells St.	481	5,027	7,806
Franklin-Orleans St.	406	4,313	1,802
Lake St.	940	9,290	5,740
Washington St.	1,163	10,820	13,635
Madison St.	548	5,172	36,761
Monroe St.	381	3,697	18,789
Adams St.	385	3,332	17,513
Jackson St.	1,148	10,181	9,671
Van Buren St.	316	4,082	6,711
Harrison St.	245	3,780	3,252
Polk St.	43	1,104	3,567
Totals	3,255	23,716	8,185

In the parks, concrete and fixed steel bridges have been erected, but along the Chicago River the land conditions are similar to those in Berlin and Paris, the land being level and flat and not permitting bridges to be erected at a sufficient height to leave the river open to navigation. Accordingly, movable bridges have been erected, some of which open 100 times a day during the navigation season. The first bridges built were of the swing type, but a number of years ago the policy of the city was changed and now bascule bridges are being constructed. In fact, the bascule type of bridge has been very highly developed by the City of Chicago.

The largest and most interesting bascule bridge in Chicago was opened in May, 1920, and forms the

(Continued on page 60)

Building the Cook County Highway System

By EDWIN J. McGINTY*

The County of Cook, Illinois, has, pursuant to law, designated 400 mi. of roads for construction as state aid roads, being 25% of the total mileage in the county. Since the creation of the Cook County Department of Highways in 1914, there have been constructed 137.48 mi. of hard-surfaced roads, in addition to 20.71 mi. under contract at the present time and 137.48 mi. designated for construction with funds derived from the sale of the recent $5,000,000 bond issue. The construction of roads built with state aid or federal aid is under the supervision of the state. Roads constructed with county funds are under the supervision of the County Department of Highways, but are turned over to the state upon completion for maintenance.

The state aid road system was designed to connect every city and village by hard-surfaced roads, special attention being given to the early construction of roads connecting the more important truck garden areas and dairy farming districts with the Chicago markets.

The first bond issue approved by the electorate of the county was for $2,000,000 and was passed in November, 1915. The second bond issue of the county was for $1,000,000 and was passed in 1917. The third bond issue, for $5,000,000, was voted in 1919. The proceeds of the last are now being used for road work.

In stimulating interest in proposed bond issues, the chambers of commerce, motor and country clubs, and commercial and civic organizations play an important part. Resolutions are passed by these organizations calling upon the County Board to submit the bond issue proposition to the voters at the next election. These organizations line up solidly behind the proposed issue and a cooperative campaign is carried on through the newspapers and motor and commercial publications to acquaint the public with the necessity of a modern highway system and to show the need for the bond issue.

All roads which have not been built with county or state funds remain under the supervision of the township highway supervisors. There are 27 townships and it is the policy of this department to give the closest possible cooperation to the local officials in order that the earth, stone, gravel and macadam roads may be built and maintained in accordance with the most modern highway practice. Nine complete road roller outfits and other equipment are owned by the county and are loaned to the townships for maintenance work on township roads. This department also cooperates with the townships in making plans and specifications. Fifty per cent. of the cost of bridges and culverts is paid from the corporate fund of Cook County. One hundred and fifty structures of various sizes, exclusive of the structures built on hard roads, have been built since 1914, at a cost of $300,000.

VIEW ON SECTION 60 OF THE FLOSSMOR ROAD, COOK COUNTY, ILLINOIS—PORTLAND CEMENT CONCRETE PAVEMENT, CONCRETE CULVERT AND GUARD RAIL

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*Chief Clerk, Cook County Department of Highways, Chicago, Ill.

MILWAUKEE AVENUE—ONE OF COOK COUNTY'S HARD-SURFACED ROADS

In 1914, contracts were lelt for 15.13 mi. of concrete road, 8 in. thick at the center and 6 in. at the edges, at a cost of $14,426 per mile. In 1915, contracts for 2.46 mi. of the same type of pavement were let for $15,093 per mile; in 1917 contracts for 9.13 mi. cost $20,858 per mi.; 8.03 mi. of this pavement in 1918 cost $25,201 per mile and in 1919, 39.26 mi. cost $29,077 per mile. While concrete is the prevailing type of pavement, some brick and asphaltic concrete pavements have been laid since 1916.

The roads of Cook County are subjected to considerable traffic. On Sunday, Aug. 8, 1920, a traffic count showed that 11,991 motor vehicles passed over Milwaukee Ave., between Ballard and Dempster Sts. On the day following, 2,721 motor vehicles passed over this road.

DEMPSTER STREET, COOK COUNTY, ILLINOIS—PORTLAND CEMENT CONCRETE PAVEMENT

Bridges in the City of Chicago

(Continued from page 58)

connecting link over the Chicago River between the north and south parts of Michigan Ave. This structure forms the main feature of the well known plan of improving Michigan Ave., which was adopted by the Board of Local Improvements in 1912. Since 1898 the work of developing and improving the trunnion bascule type of bridge has been carried on by the Engineering Bureau of Chicago, and the design of this new Michigan Ave. bridge was the culmination of many years of experience. It has two decks and is of the double-leaf trunnion bascule type. The upper level carries two roadways, each 27 ft. wide, with a cantilevered sidewalk 15 ft. wide on either side. The lower level is provided with two roadways, each 18 ft. wide, and two sidewalks 6 ft. wide, all of which are within the trusses. This is the first double deck bridge built solely for highway purposes.

The total width of the bridge is 91 ft., and the length of the span, 256 ft., with a clear span of 220 ft. between abutments. Each leaf has four trusses and weighs 3,350 tons, with a fixed counterweight weighing 1,595 tons. The counterweights are composed of concrete and scrap iron. By bolting the inner trusses together with diaphrams which can be readily disconnected, the structure may be operated as two separate bridges.

Both decks of the bridge are paved with creosoted wood block, with sandstone block on concrete back of the trunnions so as to give weight to that end of the structure.

The bridge is operated by electricity, each leaf having four 100 hp. motors, two of which are for emergency purposes. Special attention has been given to fitting the bridge with safety devices. Emergency brakes of new design have been installed, in addition to the usual pneumatic and hand brakes and a system of signalling, gates and other safety devices have been installed.

At each end of the bridge are open places, or plazas, which provide additional room for vehicles to stand while the bridge is being opened or closed. These plazas also serve as places where spectators may observe traffic or the operation of the bridge. On the south side of the structure these plazas are necessary for connecting the lower level with the railroad yards on the east and River St. on the west, the difference in elevation requiring a considerable length of slope. Also, the ornamental stone stairways leading from the upper to the lower level on each side of the river, extending along the base of the stone abutment walls, require considerable distance along the river and add much to the beauty of the bridge and its approaches.

(Concluded on page 63)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

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Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI FEBRUARY 2, 1921 No. 5

NO TIME FOR CURTAILMENT

Strict economy in highway work and the greatest possible curtailment were urged by Governor Lake of Connecticut in his message to the General Assembly last month. He put himself on record, however, as opposed to any interruption of the state's continuous policy of highway development, recommended a bond issue to meet the imperative needs of the State Highway Department and advocated a revision of the motor vehicle fees.

With Governor Lake's call for strict economy no friend of road betterment can fail to agree. Highway work should be carried on economically at all times, of course, regardless of the cost of labor and materials or of the amount of money available for use. Under present conditions economy is more essential than ever.

Curtailment is a horse of a very different color. Without knowing just what Governor Lake has in mind—just how he has used the word—it cannot be contended that he is in the wrong. If he means that useless expenditures should be cut off, waste eliminated and the efforts of the State Highway Department confined to essential work, he should have the hearty support of everyone concerned. If he means such curtailment as highway work suffered during the war, he should not receive that support. The present is no time for that sort of curtailment.

Governor Lake has had the advantage of a thorough engineering education, however, and is undoubtedly better fitted than most men in like positions to grasp the full significance of highway improvement. It is believed that his attitude is dictated by a complete understanding of Connecticut's road needs and the ways and means for meeting them.

THE CONVENTION AT CHICAGO

By the time this issue of GOOD ROADS reaches its readers the final arrangements for the A. R. B. A. convention at Chicago next week will be well under way. The meetings will begin on Wednesday, February 9, and continue for the remainder of the week. An exhibition of road building materials and equipment will be a feature of the convention, as in previous years.

At no time since the organization of the American Road Builders' Association, nearly twenty years ago, have conditions been so favorable to the holding of a meeting of this kind as they are now, nor has the need for such a gathering been so great. The rapidly changing traffic conditions during the past decade and the consequent advances in highway engineering and contracting have brought new problems and new methods to the A. R. B. A. conventions for discussion. The interchange of views and experiences there has had a far-reaching influence upon road work in this country. This year brings not only its full quota of technical problems, but also a multitude of broader questions of policy, administration and finance. For several years road betterments have been curtailed, maintenance necessarily has been more or less neglected and contractors have had to face labor and material shortages and almost prohibitive costs. In the meantime traffic has been growing at an unprecedented rate and changing rapidly in character.

Present indications are that the coming season will be an exceptionally busy one for road builders. Large sums are available for the work and there is a demand for better roads that must be met. The phenomenal increase in motor truck transportation is daily emphasizing the need for highways that can be used at all seasons. Passenger automobiles are increasing in numbers also, and are apparently making greater mileages.

In order most effectively and economically to do their work, highway officials must be fully informed as to administrative and financial matters, highway engineers must keep in touch with the progress being made in technic, and contractors must keep abreast of the times, especially in regard to machinery and equipment. Conventions are among the best means for accomplishing these things. The annual A. R. B. A. convention is conspicuously able to meet the needs of all classes of workers in the highway field, for it brings together larger numbers of officials, engineers and contractors than are gathered at any other place or time. In addition, it offers a display of road and street machinery and materials that can be seen nowhere else. The opportunity to inspect this line and to talk with the machinery and material companies' representatives is worth more to a road contractor than it possibly can cost him. To the engineers and officials the meeting with others engaged in the same kind of work, with the interchange of views that results, is of incalculable value. The convention and exhibition also give all of those engaged in road and street work—federal, state, county, city and town officials, engineers employed in various public capacities, and those in private practice, contractors engaged in road and street work, and the men engaged in manufacturing and selling machinery and materials—an unequaled opportunity to meet on the common ground of their work and formally and informally give and receive the benefits of their experience.

Thousands of road builders know from personal experience how much benefit they have derived from previous meetings of the American Road Builders' Association. It is confidently expected that at Chicago next week they can attend an A. R. B. A. convention and exhibition that will surpass previous ones.

Paving on Chicago Streets

(Continued from page 53)

foundation is required. A smooth surface implies freedom from surface irregularities, such as appreciable joints or cracks; uneveness, due to unequal surface wear or disintegration; settlement of the foundation and contour uneveness, due to raised crossings; abrupt change of grade, and excessive crown slope. No matter what the material, uniformity is the main quality the pavement construction must possess. To secure uniform results all wearing surface material is subject to rigid laboratory tests and careful inspection at the plant. Sheet asphalt pavements, as laid under present specifications, are giving excellent satisfaction. The wearing surface consists of a binder course 1½ in. thick and a top course 2 in. thick. The binder course will probably be increased to 2 in. or more where the traffic warrants heavier construction. Asphaltic concrete has proved less reliable, due to the range of climate, lack of stability and character of traffic.

Brick pavements when laid with a 1-in cushion and with the joints filled with asphalt filler, as is now our standard practice, have given excellent service. The filler, when applied with a squeegee, fills all joints and inequalities in the brick surface. The thin mat on the surface keeps the pavement smooth and keeps the joints filled and the cushion waterproof, adding greatly to the life of the pavement, because of the reduced abrasion and reduced impact. On streets the brick is 4 in. in depth while the 3-in. brick is used on alleys.

Granite block and sandstone block are usually 5 in. in depth laid on 1½ in. of sand or screenings and usually on an 8-in. concrete base of 1:3:7 mix. The joints are filled with a 1:1 mix of grout or an asphaltic sand mastic, the latter preferred. The sandstone wears less slippery than granite and gives better traction and foothold.

Creosoted wood blocks are now laid on a 1-in. sand cushion instead of the usual 1-in. mortar cushion. A bituminous cushion has proved highly successful in some experimental pavements and it no doubt will be tried out on a more extensive scale in the near future.

The penetration of water under the blocks, in combination with expansion due to almost continuous wetting, has caused several failures. The shifting of the cushion due to water and vibration is the probable source of initial failure. Creosoted wood block must be made waterproof and kept waterproof during use. This, it is confidently believed, warrants the use of bitumen in the cushion and in the filler and the addition of waterproof qualities to the impregnating oil.

Concrete pavement is used only in alleys or on private roadways. It is laid 7 in. thick and consists of a 1:2:3 mix. A bituminated surface, composed of sand and ½ gal. of bitumen per square yard of surface, is sometimes used. With good workmanship there is little advantage in using a bituminated coating.

Asphalt macadam is used in the outlying districts where traffic is light and first cost is of major importance. On a sand subgrade good results are secured. On streets having car tracks four rows of granite blocks are laid adjoining the rail to withstand the excessive wear due to vibration and the turning off and on of vehicles using the middle strip for rapid transit. In addition, a 40x10-in. granite header is being tried adjoining the four rows of granite block. This serves as a marker between the pavement proper and the pavement affected by the street railway company, although the company is responsible only for the middle 16 ft. of roadway.

Sandstone, granite and concrete curbing is used on all block pavements, while a combined concrete curb and gutter is used on all asphalt pavements. This curb and gutter has a curb 7 in. thick and averages 6 in. deep. The gutter is 12 in. wide and 8 in. deep.

The City of Chicago has 38,430,330 sq. yd. of paving, of which 7,956,330 sq. yd. are surface treated macadam; 2,508,000 sq: yd. bituminous macadam; 1,547,000 sq. yd., asphaltic concrete; 15,188,000 sq. yd., sheet asphalt; 5,749,000 sq. yd., brick; 100,000 sq. yd., Portland cement concrete; 3,472,000 sq. yd., wood block; 1,901,000 sq. yd., stone block; 9,000 sq. yd., rock asphalt. Chicago is second to New York City in yardage of paved streets, New York City having 41,000,000 sq. yd. of paving.

The amount of work done during 1920 was less than usual, due to high prices and difficulty in securing materials. Planning new improvements has gone forward and a great amount of work will be done, provided prices decline. The great growth of motor traffic and diversified ownership of automobiles have created an insistent demand for repaving old streets, through routes, and particularly, alleys.

Despite legal restrictions, expediency, and also, unfounded criticism, the "I will'" spirit is still virile and actve in achieving the Chicago of the future.

Bridges in the City of Chicago

(Concluded from page 60)

Plans for the Michigan Ave. Bridge, one of the greatest engineering features of the north central district, were prepared by the Bureau of Engineering of the Public Works Department of Chicago under the direction of Hugh E. Young, Engineer of Bridge Design; Thomas G. Pihfeldt, Engineer of Bridges; P. S. Combs, City Engineer, and C. D. Hill, Chief Engineer of the Board of Local Improvements. Wm. A. Mulcahy, Engineer-in-Charge, Michigan Avenue Improvement, was in charge of construction.

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Traffic Counts in Various States—IV

Brief Description of the Progress Made in Traffic Censuses in the Several States — Classifications Adopted — Results

By A. N. JOHNSON

(Continued from January 26)

Ohio

Except in a few isolated cases no traffic counts have been made.

Oregon

Except in a few isolated cases no traffic counts have been made by the State Highway Department. In the few instances where traffic has been counted, the classification made was as follows: Automobiles, licensed in the state, licensed outside of the state; trucks, divided according to capacity as nearly as could be judged; and horse-drawn vehicles.

Observation stations were at points about midway between important towns in order to eliminate local traffic. The counts made extended from 8 a. m. to 6 p. m., but the report recommends that they should be made throughout the 24 hours.

Pennsylvania

The only report at hand is for a traffic count made by the State Highway Department on the Lincoln Highway, taken for a 14-day period, hourly from 7 a. m. to 7 p. m., during the fall of 1920.

The classification used was as follows:

1-ton truck; 2-ton truck; 3-ton truck; 4-ton truck; 5-ton truck; touring car; motorcycle; 1-horse vehicle; 2-horse vehicle.

Rhode Island

Traffic counts were taken by the State Highway Department in 1907, 1908, 1913, 1915 and 1920. The earlier tally sheets used contained a much larger number of classifications of vehicles than the forms used at present.

An attempt was made to have the observers record the weight of vehicles, but it was found difficult to arrive at accurate figures by this method. The tabulation shows results of counts during August of different years.

The classification now in use divides vehicles into: automobiles, motorcycles, auto trucks, heavy wagons and light wagons.

Observations were made at 19 stations on different roads throughout the state, so selected that the results would not be influenced by purely local traffic.

The traffic census has been used as a basis for designing roads and planning expenses. Count is made from 6 a. m. to midnight. The tabulation at hand shows that the census was taken for seven consecutive days about Aug. 1, during 1913, 1915 and 1920, but gives no indication as to the time of previous counts.

It is noted that the increase of all traffic in 1920 over that of previous years varies from 52% to 378%, but at all points remarkably uniform decrease in wagon traffic is recorded, varying from 54% to 89%. The average daily number of trucks has increased enormously, being as high as 1113% on one road and none reported less than 156%.

(Continued on page 79)

The Associated Road Organizations of Chicago and Cook County

By W. G. EDENS*

The Associated Road Organizations of Chicago and Cook County was organized about eight years ago with the purpose of the "promotion of good roads and the proper distribution of the vehicle tax fund in Chicago," with special reference to the construction and maintenance of through route streets from the heart of the city to the city limits, where they connect with county or state highways. There are approximately 1,500 mi of roads in Cook County, of which about 400 mi. were designated for improvement by state aid or county bond issue funds, so that each town or village would be connected with the others and with the principal highways leading to Chicago and adjoining counties.

WILLIAM G. EDENS
President

ROBERT W. DUNN
Vice President

NEWTOWN C. FARR
Secretary

HENRY H. PAULMAN
Treasurer

Officers of the
ASSOCIATED ROAD ORGANIZATIONS
OF CHICAGO AND COOK COUNTY

The organization has conducted three county campaign for road bond issues. First, a $1,000,000 bond issue was voted; later a $2,000,000 issue was approved, and finally, two years ago, a $5,000,000 issue was carried by a big vote. The Associated Road Organizations also was active in the campaign for the $60,000,000 Illinois state bond issue, which was passed in 1918.

Since the time the association was first organized, frequent meetings have been held at various hotels and clubs, and members have been active in participating in road dedications, inspection trips, etc. The officers and directors confer frequently with the Finance Committee of the Chicago City Council, endeavoring to secure specified sums to be expended for the improvement and maintenance of through streets. Other conferences are held frequently with the Board of Local Improvements, the Commissioner of Public Works and the Superintendent of Streets and Alleys.

The Committee on Good Roads of the County Board and the officers of the board are often consulted with and meetings of these bodies attended when the county road program of construction and repair is under consideration. Friendly relations have been maintained with the Cook County Township Highway Commissioners Association and with the village and town boards of the 102 villages and towns in the county. During the past two years a number of conferences have been held with members of the Board of the Chicago Drainage District, which has resolved to build some modern boulevards along the banks of the Chicago Drainage Canal.

The affiliated members of the association are: Beverly Country Club, Chicago Association of Commerce, Chicago Athletic Association, Chicago Automobile Club, Chicago Automobile Trade Association, Chicago Cartage Club, Chicago Motor Club, Cook County Truck Gardeners and Farmers' Association, Evanston Golf Club, Furniture, Piano Movers and Expressmen's Association, Hamilton Club, Idlewild Country Club, Illinois Athletic Club, Illinois Motor Club, Iroquois Club, LaGrange Auto Club, Midlothian Club, Olympia Field Country Club, Ravisole Country Club, Retail Dry Goods Association, South Shore Country Club, Touring Club of America, Chicago Division.

From this list of affiliated members it is plain that the association has the cooperation of commercial and automobile asociations of the city, together with truck gardening and farms groups, and the inhabitants of the villages and towns of the county. I

(Concluded on page 71)

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*President, Associated Road Organizations of Chicago and Cook County.

The American Road Builders' Association and the Chicago Convention

Growth of Sentiment for Good Roads and the Place of the Association in the Movement — Its Organization and History — Conventions Held in Past Years — Present Officers and Directors — Program Coming Eighteenth Annual Convention and Twelfth Good Roads Show at Chicago

Aladdin could scarcely have been more delighted to enter the "Garden of Jewels" than is the American road builder on being ushered into the year 1921. Today more than a billion dollars are available to carry on the great movement for better highways, a sum of money outside the realm of imagination of the road maker of a score of years ago, when highway engineering was a state of mind and the road a perverted state of matter.

M. J. FAHERTY
President

And as Aladdin used his magic lamp to summon genii to bring forth food and riches, so have the road builders in this country used their energies in directing the great forces of this land so as to bring forth magically a system of improved highways extending to all quarters of the country. In the short period of a quarter of a century the road program has assumed such proportions that it now constitutes the greatest plan of public improvement ever projected in history.

J. A. DUCHASTEL
Vice President
Northeastern District

LT. COL. H. L. BOWLBY
Vice President
Southern District

R. C. TERRELL
Vice President
Central District

S. BENSON
Vice President
Western District

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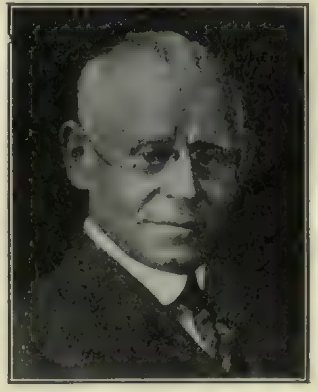
Secretary



J. H. MACDONALD
Treasurer

EXECUTIVE OFFICERS
American Road Builders' Association
1920—1921

The desire for a system of improved highways permeates the entire land, as seen in the fact that on one day, Nov. 2, 1920, the electorate of various states and counties voted for the expenditure of nearly half a billion dollars for highway improvement. The hope for complete social, industrial and commercial unification of the country lies in the creation of a system of serviceable highways, and upon the road builder devolves the task of bringing about the realization of this hope.

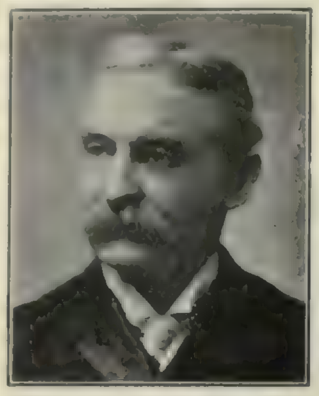
The standard bearer of this onward march of road development is the American Road Builders' Association, which will hold its annual conventon in Chicago, Ill., on Feb. 9, 10, 11 and 12, 1921. This organization, started in the period of transition from bicycle to automobile, is the oldest and largest body of its kind in the country, embracing in its membership, federal, state, city and county highway officials, together with engineers, contractors and manufacturers of road building materials and equipment.

The American Road Builders' Association was organized in 1902, when a small group of men met in New York City and formed the society then called the American Road Makers. The first convention was held in Detroit, Mich., on

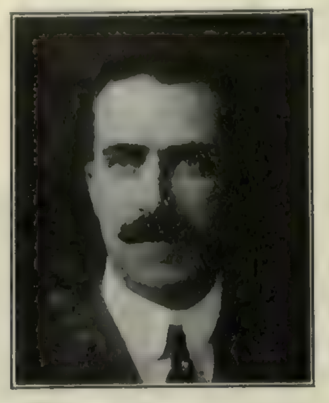
Feb. 13 and 14, 1903. At that time few states possessed highway departments and the economic importance of the construction and maintenance of highways had not yet been realized by the public. The science of road building also was at that time undeveloped, and road builders, lacking the dicta of experience, were busily engaged in experimenting with various methods and materials of construction. Consequently, the benefits of getting together and exchanging experiences and opinions were so evident, that the leaders of the association decided to hold annual meetings.

In 1904 the second annual convention was held in Hartford, Conn., with an attendance of 1,129. Because of the success the first two annual meetings enjoyed, it was decided to extend the length of time devoted to the convention from two to three days. Accordingly, the third conventon was held in Port Huron, Mich., on August 29, 30 and 31, 1905. The fourth convention was held at Pittsburgh, Pa., in 1907, the fifth at Buffalo, N. Y., in 1908, and the sixth at Columbus, O., in 1909.

An important innovation was inaugurated at the Columbus convention in the holding of an exhibit of road machinery and materials in conjunction with the meeting of the assocation. By means of this Good Roads Show, manufacturers of materials and equipment were enabled to demonstrate the most recent and approved methods used in road building. This exhibit at once became a permanent feature of the annual convention, being omitted but once, in 1915, when a joint meeting with the American Highway Association was held in Oakland, Cal., during the Panama-Pacific International Exposition. The length of the meeting also was lengthened to four



Geo. W. Tillson*



A. W. Dean*

H. E. Breed*

W. A. McLean

I. W. Patterson

Wm. R. Smith

H. K. Bishop

C. M. Upham

C. J. Bennett

Lt. Col. W. W. Crosby

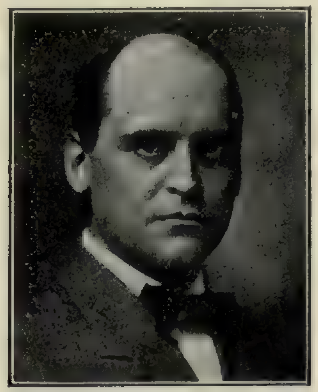
R. A. Meeker

DIRECTORS—AMERICAN ROAD BUILDERS' ASSOCIATION (*Past Presidents, ex-officio members) days at the Columbus convention, so as to permit thorough discussion of the growing problems in the road industry.

As the automobile developed, the problems of road building increased. With slow moving horse-drawn vehicles, carrying comparatively light loads, the problems of road design and construction were simple, compared with those created by fast moving motor vehicles having a total weight of several tons and capable of producing enormous impact stresses upon the road surfacing. To meet this revolution in passenger and freight transportation, it was necessary to build heavier and stronger highway structures. Another important change wrought by the advent of the motor vehicle was that the desire for better roads spread throughout the land, supplanting an inordinate opposition to road expenditures which had generally prevailed.

A. H. Blanchard*

Geo. P. Coleman*


A. B. Fletcher

M. F. Bramley

F. E. Everett

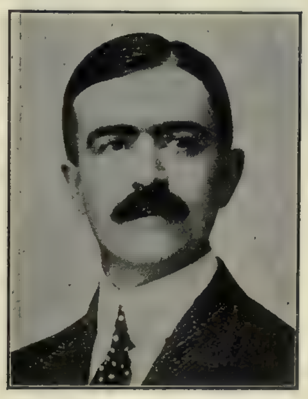
Samuel Hill

J. Frank Smith

F. F. Rogers

O. C. Rollman

Col. Wm. D. Sohier


Lt. Col. W. D. Uhler

DIRECTORS—AMERICAN ROAD BUILDERS' ASSOCIATION. (*Past Presidents, ex-officio members)

Recognizing that the scope of its activities was fast increasing, in 1910 the American Road Makers reorganized, without capital, under the laws of New York, changing its name to the American Road Builders' Association. In the same year the annual convention was held in Indianapolis, Ind., on Dec. 6, 7, 8 and 9, with an attendance of over 1,400.

The following year the eighth annual convention and third exhibition of road materials and equipment were held in Rochester, N. Y., on Nov. 14, 15, 16 and 17, with an attendance slightly larger than the previous convention. At this convention the method of conducting the proceedings was changed by devoting each session to a particular topic.

The ninth annual convention was held in 1912 at Cincinnati, O., the tenth at Philadelphia, Pa., in 1913 and the eleventh at Chicago, Ill., in 1914. All of these annual meetings were well attended and the association continued to grow.

During the Panama-Pacific International Exposition in 1915, the association held its annual meeting in conjunction with the American Highway Association. In 1916 the annual convention was held in Pittsburgh, Pa., and in 1917 in Boston, Mass. The exhibitions of machinery and materials at these last two conventions were particularly large and interesting.

In 1918 and 1919 the annual conventions were held in St. Louis, Mo., and New York, N. Y., respectively. Because of war conditions prevailing at the time, exhibits of heavy machinery were omitted and the conventions were held in hotels. In 1920, the seventeenth annual convention was held in Louisville, Ky., with an exceedingly large and varied number of exhibits of modern labor savng road machnery.

The membership of the assocation is divided into five classes; active, life, sustaining, contributing and honorary. Active members are persons engaged or interested in highway work paying annual dues of $3.00. Life membership is secured upon payment of $50. Sustaining members are organizations contributing $200 yearly. Contributing members are organizations which pay $50 per year. Only active or life members have the privilege of voting or holding office.

The directors of the association, 21 in number, are elected sectionally, i. e., 10 must reside in the northeastern district, 4 in the southern district, 5 in the central district and 2 in the western district of the territory composing the United States and Canada. The last five living past presidents of the association are also members of the board of directors.

WM. HALE THOMPSON
Mayor

MRS. GEO. B. ANGELL
Ladies' Entertainment

A. C. CRONKRITE
Accommodations

JOHN L. FERGUSON
Transportation

WM. D. McJUNKIN
Publicity

JOHN P. GARNER
Reception

CHAS. M. HAYES
Entertainment

JOHN J. McCARTHY
Finance

MAYOR THOMPSON AND THE CHAIRMEN OF THE CHICAGO COMMITTEES

At its recent meeting in November, the association elected M. J. Faherty, President of the Board of Local Improvements, Chicago, Ill., as its president. As executive head of the body carrying out one of the greatest plans of public improvement in this country, the improvement of Michigan Avenue, Chicago, a word about the career of the president of the association undoubtedly will be of interest. Mr. Faherty was born on a farm at Warehouse Point, Conn., in 1880. He learned the machinist's trade at an early age, which in those days before the modern minute division of labor, included work in steam fitting, plumbing, cabinet making, and the like.

Early in life Mr. Faherty went to Chicago and worked at his trade, investing his savings in real estate, entering this field as subdividor, a few years after coming to Chicago. At that time the real estate men laid only sidewalks and water mains, leaving the purchaser to take care of other assessments, such as paving, sewer, etc. Because many people were unable to bear this additional burden while paying for the property, and in consequence losing what they had invested, Mr. Faherty adopted the plan of installing all improvements. In this manner he became interested in street paving, and since that time has had to do with almost every kind of street pavement. In 1915 he became president of the Chicago Board of Local Improvements, which supervises the expenditure of fifteen to twenty millions of dollars per year.

The present officials of the association are: President, M. J. Faherty, President, Board of Local Improvements, Chicago, Ill.; Vice President, Northeastern District, J. A. Duchastel, City Engineer and City Manager, Outremont, Canada; Vice President, Southern District, Lt. Col. H. L. Bowlby, Chief, War Materials Division, U. S. Bureau of Public Roads, Washington, D. C.; Vice President, Central District, Robert C. Terrel, State Engineer of Oklahoma; Vice President, Western District, S. Benson, Former Chairman, Oregon State Highway Commission, Portland, Ore.; Secretary, E. L. Powers, Editor, GOOD ROADS, New York, N. Y.; Treasurer, Senator James H. MacDonald, New Haven, Conn.

Past Presidents: George W. Tillson, Consulting Engineer, LaGrange, Ill.; A. W. Dean, Chief Engineer, Division of Highways, Massachusetts Department of Public Works; H. E. Breed, Consulting Highway Engineer, New York, N. Y.; A. H. Blanchard, Professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Mich.; Geo. P. Coleman, State Highway Commissioner of Virginia.

Directors: H. K. Bishop, General Inspector, U. S. Bureau of Public Roads, Washington, D. C.; M. F. Bramley, President, Trinidad Paving Co., Cleveland, O.; F. E. Everett, State Highway Commissioner of New Hampshire; Samuel Hill, Honorary Life President of the Washington State Good Roads Association; J. Frank Smith, Manager, Good Roads Association of Greater Kansas City, Kansas City, Mo.; C. M. Upham, Chief Engineer, Delaware State Highway Department; T. J. Wasser, State Highway Engineer of New Jersey; Charles J. Bennett, State Highway Commissioner of Connecticut; Lt. Col. W. W. Crosby, Consulting Engineer, Baltimore, Md.; R. A. Meeker, Right-of-Way Engineer, New Jersey State Highway Department; F. F. Rogers, State Highway Commissioner of Michigan; O. C. Rollman, Division Maintenance Engineer, Wisconsin State Highway Commission; Lt. Col. W. D. Uhler, Chief Engineer, Pennsylvania State Highway Department; Irving W. Patterson, Chief Engineer, Rhode Island State Board of Public Roads; William R. Smith, President, Lane Construction Corp., Meriden, Conn.; John Swan, Director of Public Works, Pittsburgh, Pa.; J. H. Cranford, President, The Cranford Paving Co., Washington, D. C.; W. G. Sucro, County Roads Engineer, Baltimore County, Maryland; W. A. McLean, Deputy Minister of Highways, Province of Ontario, Canada; A. B. Fletcher, State Highway Engineer of California.

Executive Committee: M. J. Faherty, H. L. Bowlby, J. H. MacDonald, E. L. Powers, C. M. Upham.

The coming convention of the association and the exhibit will be held at the Coliseum, Chicago, Ill., on Feb. 9, 10, 11 and 12. An elaborate program of topics for discussion has been prepared, in which are included problems whose solution will greatly accelerate highway construction by overcoming or circumventing the causes of delay which prevailed in 1920. At this writing practically all the exhibition space has been taken up by manufacturers of road materials and equipment, thereby assuring the complete success of the convention and road show.

The Chicago Executive Committee is composed of the following:

M. J. Faherty, President of the Association, Chairman; Peter Foote; Oscar Wolff, Member, Chicago Board of Local Improvements; A. C. Cronkrite, Division Sales Manager, Universal Portland Cement Company; C. M. Hayes, President, Chicago Motor Club; Robert W. Dunn, President, Hamilton Club; H. A. Hooker, Advertising Manager, Austin Machinery Corporation; Z. W. Carter, Sales Manager, Austin Machinery Corporation; Harry Goldstine, Valuator of Real Estate; John W. Ferguson, General Passenger Agent, Chicago Northwestern Railroad; C. E. Mateer, Executive Secretary, Illinois Association of Highway and Municipal Contractors; A. W. Stanmeyer, President, Cook County Real Estate Board; John B. Hittell, District Engineer, the Asphalt Association; G. B. Bartlett, Portland Cement Association; John J. McCarthy, President, Conway Paving Co.; Royal Allen, Secretary of the Chicago Executive Committee.

The officers of the sub-committees are as follows:

Finance: John J. McCarthy, Chairman; William C. Kirby, Secretary.

Transportation: John L. Ferguson, Chairman; John H. Cook, Secretary.

Ladies' Entertainment: Mrs. G. B. Angell, Chairman.

Entertainment: Charles M. Hayes, Chairman; Royal Allen, Secretary.

Accommodations: A. C. Cronkrite, Chairman; Z. W. Carter, Secretary.

Publicity: William B. McJunkin, Chairman; H. A. Hooker, Secretary.

Reception: John Garner, Chairman; Henry Kramer, Secretary.

PROGRAM

TUESDAY, FEBRUARY 8TH

Formal opening of the Twelfth National Good Roads Show, Coliseum, 8 p. m.

WEDNESDAY, FEBRUARY 9TH

First Session

Coliseum, 9 a. m.

H. L. Bowlby, Chief, War Materials Division, U. S. Bureau of Public Roads, presiding.

Meeting called to order by M. J. Faherty, President, American Road Builders' Association.

Invocation.

Announcement of Convention Committees.

Paper: "Our National Road Problems," by Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads.

Paper: "Relation of the Highway and Motor Transport Movement to Education," by Prof. C. J. Tilden, Director, Highway and Highway Transport Committee, U. S. Bureau of Education.

Paper: "Highway Improvement in New England."

Paper: "The Local and National Importance of the Lee Highway," by S. M. Johnson, Director, Lee Highway Association.

Second Session

Coliseum, 2 p. m.

George C. Diehl, County Engineer, Erie County, New York, presiding.

Paper: "The Highway's Part in the Development of Efficient Transportation," by C. W. Reid, Manager, Transportation Bureau, Federal Highway Council.

Discussion by T. J. Wasser, State Highway Engineer of New Jersey; D. C. Fenner, Chairman, Motor Vehicle Conference Committee; F. W. Fenn, Secretary, Motor Truck Committee, National Automobile Chamber of Commerce.

Mass Meeting

Medinah Temple, 8 p. m.

M. J. Faherty, President, American Road Builders' Association, presiding.

Musical Program, Great Lakes Naval Training Station Band and Hamilton Club Chorus.

Address of Welcome on Behalf of the City of Chicago, by Mayor William Hale Thompson.

Response on behalf of the American Road Builders' Association, by President Faherty.

Motion Pictures.

THURSDAY, FEBRUARY 10TH

Third Session

Coliseum, 10 a. m.

C. M. Upham, Chief Engineer, Delaware State Highway Department, presiding.

Paper: "Subgrades," by H. G. Shirley, Secretary, Federal Highway Council.

Discussion by Clifford Older, Chief Highway Engineer of Illinois, and others.

Paper: "Importance of Drainage in Road Construction," by F. H. Eno, Professor of Engineering, Ohio State University.

Discussion by H. S. Mattimore, Testing Engineer, Pennsylvania State Highway Department, and others.

Fourth Session

Coliseum, 2 p. m.

J. A. Duchastel, City Engineer and Manager, Outremont, P. Q., presiding.

Paper: "Types of Pavements," by Senator James H. MacDonald, former State Highway Commissioner of Connecticut.

Discussion by Newell D. Darlington, State Highway Commissioner of California; Herbert Nunn, State Highway Engineer of Oregon; and others.

Paper: "Highway Researches and What the Results Indicate," by A. T. Goldbeck, Testing Engineer, U. S. Bureau of Public Roads.

Discussion by Anson Marston, Dean, Iowa State College, and others.

Dinner Dance

Gold Room, Congress Hotel, 6 p. m

FRIDAY, FEBRUARY 11TH

Fifth Session

Coliseum, 10 a. m.

Frank F. Rogers, State Highway Commissioner of Michigan, presiding.

Papers on: "Recent Developments in Road Building," by Edward N. Hines, Chairman, Board of County Road Commissioners, Wayne County, Michigan; W. D. Uhler, Chief Engineer, Pennsylvania State Highway Department; R. Keith Compton, Chairman, Paving Commission, Baltimore, Md.; and others.

Sixth Session

Coliseum, 2 p. m.

Howard F. Beebe, Vice President, Harris, Forbes & Co., New York, N. Y., presiding.

Paper: "Highway Finance," by H. C. Sylvester, Vice President, National City Co., New York, N. Y.

Discussion by S. E. Bradt, Superintendent of Highways of Illinois; H. P. Gillette, Editor, "Engineering & Contracting;" and others.

Theater Parties

Two Chicago theaters, 8 p. m.

SATURDAY, FEBRUARY 12TH

Seventh Session

Coliseum, 10 a. m.

Walter A. Rogers, of Bates & Rogers, Chicago, Ill., presiding.

Paper: "Relations Between Engineers and Contractors," by W. A. Rogers.

Discussion by R. G. Collins, Keystone Construction Co., A. R. Hirst, State Highway Engineer of Wisconsin; D. A. Garber, President, Northeastern Construction Co.

Eighth Session

Coliseum, 2 p. m.

Question Box.

Report of Resolutions Committee.

Election of Nominating Committee.

Adjournment.

The Associated Road Organizations of Chicago and Cook County

(Concluded from page 64)

know of no better example of community cooperation than that furnished by the people of our city and county, as it relates to our comprehensive good road improvement program. There has been a genuine spirit of cooperation prevailing at all times, and the organization has always had the confidence and respect of the voters of the city and county, who have responded in providing funds for every program for highway improvement which has been presented to them by the association.

Reduced Railroad Rates to Chicago for American Road Builders' Convention

As noted in GOOD ROADS of Jan. 26, the Central and Western Passenger Associations have granted a special rate of one and one-half fare to persons attending the Chicago convention of the American Road Builders' Association, to be held on Feb. 8 to 12. Since then the Trunk Line Association has made a similar concession and it is expected that other passenger associations will take similar action.

In order to take advantage of the reduced fare, it is necessary to ask for a certificate when purchasing the railroad ticket to Chicago. The ticket agent will give this certificate when asked, and it should be presented to the secretary of the association at Chicago for endorsing. A special railroad agent will be at Chicago to validate certificates, which will permit the purchase of the return trip ticket at half fare. Unless the certificate is secured and validated by the special agent, reduced fare cannot be secured.

Maricopa County, Arizona, Passes Second Bond Issue

Labor Saving Machinery and Methods are Used to Build 280 Miles of Road in County

Voters of Maricopa County, Arizona, recently passed a $4,500,000 road bond issue, which will be used with a $4,000,000 bond issue voted a little over a year ago to carry on the extensive road building program of the county. It is expected to pave with concrete about 280 mi. of roads in the county.

The first laying of concrete took place on Nov. 12, 1920. Two mixers were placed at what is known as Fowler set-up and are working on a 41-mi. section of road. Materials are delivered in bottom dump railroad cars which are shunted on top of a material trestle and dumped direct into bunkers under the trestle from which the tip-over batch boxes are loaded by gravity.

Sand and gravel are obtained from Tempe, where Twohy Brothers, the contractors, have installed a washing and screening plant having a capacity of 1,500 yd. per day. Cement is received in bulk and unloaded by means of a Dracco vacuum plant arranged and furnished for this job by the Lakewood Engineering Co. From the time the cement is loaded into the railroad cars at the mill, it does not touch the ground until placed on the road in the concrete. The most modern methods are used in every operation.

The equipment, representing an investment of nearly $500,000, includes four Lakewood gasoline pavers with batch transfers, 18 mi. of narrow gauge track, 12 6-ton gasoline locomotives, 216 road cars with batch boxes and cement compartments, 8 double truck cars, 4 finishing machines, 4 subgraders, 2 bulk cement handling plants each having a capacity of 900 bbl. per day, 8 scarifiers and 1 clamshell bucket.

Locating Engineer Defined

Son: What is a highway locating engineer?

Father: Oh, he's the fellow from the state highway department who comes around in the winter and tries to locate the place where the roads were in the summer.

New Use of Cofferdam

Teacher was explaining to her class the use of cofferdams in building the piers for the new bridge across the river. Willie Jones was not paying attention, so teacher called upon him to make up a sentence using the word cofferdam. Willie hesitated and then said,

"Mary Riley borrowed my gum and now she has swallowed it, and I hope she'll cofferdam head off."

Road Plans of Missouri

Tentative Program Includes 1,667 mi. of Primary and 2,918 mi. of Secondary Roads

In accordance with the action taken at the November election in Missouri authorizing the Legislature to issue $60,000,000 of road bonds, John M. Malang, State Superintendent of Highways, has prepared a map for a tentative system of highways.

The proposed plan calls for five main highways to be built of concrete. Two of these are to run east and west through the more thickly settled parts of the state. Two are to run north and south, one following the Mississippi River and the other the western border of the state. The fifth road is to extend from St. Louis southwesterly to the Kansas line, following the Frisco Railroad.

In addition to these primary routes, the plan contemplates the construction of secondary roads of gravel in every county in the state.

The total mileage of the primary road system outlined by Mr. Malang is 1,667.4, and of the secondary system, 2,918.3, making a total mileage of 4,485.7 mi.

Short Course in Highway Engineering at the University of Missouri

The School of Engineering of the University of Missouri will give an eight weeks' course in highway engineering to train the men that will be require in carrying out the great road building program of Missouri. The course will be in charge of Prof. R. W. Selvide.

Employment of American Road Builders Opposed by Japanese Engineers

Responding to a proposal that the City of Tokio, Japan, employ three American highway engineers, ten assistants and twenty-five skilled road workmen, the engineers of that city have entered vigorous protest against the plan of the city officials. The City of Tokio plans to spend 60,000,000 yen for street improvement during the next seven years.

Court Holds State Not Liable for Injuries Received on Highway

The Supreme Court, Boston, Mass., recently ruled that the state is not liable for injuries received while highways are being constructed or repaired. This decision was made in the case of Elizabeth and Solomon Lemon, of Springfield, Mass., whose automobile struck an iron horse placed on the highway where repairs were being made, both of the plaintiffs being injured.

May Investigate Cement Industry in Missouri

A resolution was introduced on Jan. 14 in the Missouri House of Representatives by Representative Dyott, calling for an investigation of the cement industry in Missouri. The resolution, reciting that the demand for cement in road building has grown to large proportions and that the supply is limited and the price prohibitive, authorizes the appointment of a committee of five to investigate the feasibility of the state's manufacturing its own cement.

Highway Funds of Washington

Although the proposed road bond issue was defeated in the State of Washington, considerable work will be done in that state.

The estimated highway funds for the next two years are as follows: Public highways, $2,400,000; motor vehicle fees, $4,100,000; permanent highways, $3,581,000; road and bridge, governed by county levy, $6,725,000; district, governed by county levy, $7,700,000. It is thought probable that the Legislature will also appropriate $2,000,000 additional for a maintenance fund for counties.

Bridge Work in the Province of Quebec, Canada

The Province of Quebec, Canada, last year constructed 50 bridges and now has 67 bridges under construction, according to a recent report by the Department of Public Works. Applications for 200 additional bridges are now under consideration. Two bridges and 32 mi. of toll road were taken over during the year, at a cost of $609,000.

Indiana to Use Leaner Mix for Concrete Roads

New specifications for concrete roads will be issued shortly by Indiana, reducing the amount of cement to be used in building concrete roads. The new specifications will call for a cement content of 1.7 bbl. of cement for each cubic yard, instead of 1.91 bbl., or a reduction in the amount of cement used of approximately 10%.

Validity of Alabama Road Bond Amendment Attacked

A suit has been filed which attacks the validity of the Alabama road bond amendment. Because of delay in preparing briefs, it is expected that a decision will not be rendered until early in February. An election will be held in the state for the purpose of raising the interest rate on $5,000,000 of road bonds to 6% and it is hoped that decision on the case can be obtained before that time, for if the amendment is declared invalid, the amendment of the interest rate would also be invalid.

Highway Work in Indiana

Increased Appropriation Is Necessary To Carry on Road Work and Meet Federal Aid

Indiana plans to construct 120 mi. of highways in 1921, according to L. H. Wright, Director of the Indiana State Highway Department. In order to carry out this work a substantial increase in appropriations by the 1921 Legislature will be necessary. Contracts for highway construction amounting to $5,000,000 must be let before June 30 so that the state will receive its federal aid allotments.

Although 152 mi. of paving were under contract in 1920, only 45 mi. were completed. Federal aid contracts for road work aggregate $4,945,719, of which amount $2,174,319 has been paid out. The department has also $350,290 of federal aid bridges under contract, on which $127,590 has been paid.

The department, on Jan. 1, had 28 county road projects under contract for 57.72 mi. of road, with about 32.87 mi. completed. In addition, a county aid bridge is under construction in Fountain County, which will cost $302,448, and seven state aid bridges which will have a total cost of $47,791.

Road Work and Road Funds in Connecticut

Highway Commissioner Reports $40,000,000 Needed in Next Two or Four Years to Solve Serious Transportation Problem—Governor Urges Economy Without Interruption of the Continuity of the State's Highway Policy

"An aproximate expenditure of $40,000,000 within the next two or four years would probably bring Connecticut up to a point where its highway facilities would meet its transportation needs," according to a report submitted to Governor Lake and the General Assembly by State Highway Commissioner Charles J. Bennett of Connecticut.

A considerable portion of the report is devoted to a discussion of the effect of heavy motor trucking on the highways, pointing out that the wear and tear upon the roads necessitate the expenditure of millions to keep the highways in repair. "The state," he says, "is faced with the necessity of considering serious transportation problems."

Included in these problems, according to Commissioner Bennett, is the construction of 120 mi. of hard-surfaced pavements to accommodate present traffic. He points out that at an average cost of $75,000 per mile, this would call for an expenditure of $9,000,000. In addition, there is needed enough to bring the bridges up to a standard carrying capacity and to provide for the general improvement of feeder highways so that the maximum efficiency can be obtained from the motor vehicles now owned in the state.

The winter of 1919-1920, Commissioner Bennett points out, was one of the most severe in years. This, with the scarcity of labor, curtailed railroad traffic and threw an unusual burden on the highways. The insufficient number of trucks available led to overloading which meant undue wear on the roads and a need for additional maintenance work.

In reference to traffic, Commissioner Bennett reports that there are 90,000 passenger cars and 20,000 commercial vehicles licensed in the state at present. On the Boston Post Road, between Bridgeport and New Haven, a 72-hour continuous count showed a total traffic of 20,000 vehicles, or an average of over 200 an hour. The maximum during a certain period was about 800 an hour. Commissioner Bennett also states that only 630 of the trucks in the state are of greater capacity than 4 tons, while approximately 16,000 are of 2 tons capacity or less. Among the suggestions made by Commissioner Bennett is an increase in the license fees for trucks.

The net outlay of the Highway Department, from June 30, 1919, to July 30, 1920, was $5,018,900, according to the report. The net income from automobile fees was $1,816,800. The construction of new roads cost $1,434,648, while the maintenance and reconstruction of roads cost $2,563,637. The total built during the year was 42.66 mi.

In Governor Lake's message, made public at about the time Commissioner Bennett's report was given out, he called attention to the need for practicing strict economy and effecting the greatest possible curtailment, though expressing his belief that it would be unwise to interrupt th estate's continuous policy of highway development. He recommended a bond issue to meet the imperative needs of the State Highway Department. He also favored a revision of the automobile license fees with a view to placing upon these large users of the highways a reasonable burden for their maintenance.

Comptroller of New York Upheld in Withholding Contract Payment

The right of the Comptroller of the City of New York to withhold payment on paving contracts was upheld in a decision given on Jan. 18 by the Brooklyn Supreme Court, pending an investigation as to whether there was collusion in the bidding or fraud in the performance of the contracts. The decision has a far-reaching effect because there has been considerable delay in payment since disclosure of collusive bidding made in testimony before the Lockwood Committee, which is investigating city contracts.

The decision was on the application of the H. J. Mullen Contracting Co., for a writ of mandamas requiring the comptroller to make immediate payment of $35,244 alleged to be due for paving work.

Important Road in Lincoln National Forest Completed

About 21 Miles of Highway in New Mexico State System Built by Otero County and the Forest Service at a Cost of $89,000

The Cloudcroft-Weed section of the Highrolls-Weed Road in the Lincoln National Forest, Otero County, New Mexico, has recently been completed by the county and the Forest Service.

This road is an important link in the New Mexico state highway system and, with the section between Highrolls and Cloudcroft, which was completed about a year ago, will greatly facilitate the hauling of market produce and supplies from the Sacramento mountain region to Cloudcroft, which is the shipping point. It is also expected to carry a large amount of tourist traffic.

The section recently completed is 20.86 mi. in length and was built under a contract awarded to Ralls & Cunningham, at an estimated cost of $89,099.34. Otero County paid $15,000 of the cost and the balance was paid from the national forest road appropriation. The cost of the section between Highrolls and Cloudcroft was shared equally by Otero County and the Federal Government.

HIGHWAY TRANSPORTATION

Motor Trucks in New York State

There are approximately 800,000 motor trucks in use in the United States, of which 110,000 are registered in the State of New York. The increase in the number of trucks in New York is as follows:

Year	Number of Trucks
1912	7,606
1913	9,000
1914	14,864
1915	23,288
1916	34,653
1917	55,402
1918	92,979
1919	97,346
1920	110,000

New Type of Motor Bus

A motor bus of new design has recently been brought out by the Pierce-Arrow Co., Buffalo, N. Y., which seats 25 persons. This bus is mounted on a 2-ton dual valve Pierce-Arrow chassis and attains a speed of about 23 mi. per hour. The body is of steel and is fitted with safety devices, electric lights, push buttons, heating system, window screens and shades. The driver and passengers are afforded a clear vision on all sides. Although commodious, the bus is so designed as not to give the impression of bulkiness and it conforms to all regulations.

INTERIOR OF NEW PIERCE-ARROW BUS

Speaking in connection with the introduction of this new type of bus, Robert O. Patten, Truck Sales Manager of the company, says:

"The electric railway industry has come to regard the motor truck as an ally; not as a competitor. The bus enables the electric railway to give service in newly-opened sections without going to the enormous expense of laying tracks and investing in new rolling stock. It likewise can be used to relieve the heavy passenger service during rush hours.

"In cities where trolley companies have added motor buses to their equipment, experience has shown that the bus service is comparable in headway, speed, fare, transfer privilege and economy of operation with the trolley service."

Motor Truck Aids Transportation of Road Materials

Although the motor truck has rapidly risen to an important place in the transportation of many commodities, the road building industry in particular has benefited by its use. The handling of materials has been speeded up, sand, gravel and stone, too distant for transportation by horse and wagon, have been made available, and the use of labor saving machinery, such as the central mixing plant, has been made possible by the use of the motor truck.

The accompanying illustration shows a 3½-ton Acme truck owned by Bert Sniffen, which was used in transporting stone for the construction of a road near Geneva, N. Y., called the Finger Lake Road. Loading of the stone was done by means of a chute, the operation requiring two to five minutes. On the average, three round trips of 4 mi. each were made each hour and, as the average load carried was about 5 tons, the total tonnage ran over 150 tons a day.

ACME TRUCK CARRYING ROAD MATERIAL

"Covering a period of 100 days," said Mr. Sniffen, "my Acme hauled stone a distance of 1½ to 2½ mi. nine to twelve hours a day, mostly over dirt roads. The material was No. 3 and 4 stone, a load of 4 cu. yd. weighing about 5 tons. During this period I used $229 worth of gasoline and $225 worth of oil, with the motor running continuously practically all the day. My only repair during this time was replacing a gasket on the carburetor, costing $2.40."

Syracuse University Has Motor Transportation Course

The College of Business Administration, Syracuse University, will give a course in motor transportation, under the direction of Charles L. Raper, Professor of Transportation. This course has been endowed by H. H. Franklin, President of the Franklin Motor Car Co.

Motorization of City Departments Increases

Approximately 10,000 motor vehicles are in the service of cities in this country, according to the National Automobile Chamber of Commerce. This number includes both passenger automobiles and trucks and is increasing rapidly. New York City has 439 motor trucks and 295 passenger cars in use. Fire departments of cities are becoming more rapidly motorized than the other departments.

Bridge and Ferry Traffic in New York City

No less than 187,000 vehicles use the bridges of Greater New York in a single day, and the amount of bridge traffic in a year's time is computed at 62,500,000. The traffic figures follow:

	Daily	Yearly
East River bridges (4)	67,000	22,500,000
Harlem River bridges (9)	50,500	16,500,000
Bronx bridges (6)	12,500	4,000,000
Brooklyn bridges (6)	32,500	11,000,000
Richmond bridges (2)	870	290,000
Queens bridges (5)	8,972	3,000,000
Newtown Creek bridges (4)	15,000	5,000,000
Total	187,000	62,359,000

The number of vehicles carried by ferry lines under city control is as follows:

	Daily	Yearly
Staten Island	1,800	600,000
39th St.	870	290,000
92d St.	520	170,000
Total	3,190	1,060,000

Motor Trucks in Mail Service

Fifty per cent. of the vehicles used in the United States mail service are motor trucks, according to the annual report of Postmaster General Burleson. The post offices in 163 cities and 839 rural routes are using motor vehicles.

"The efficiency of the government owned motor vehicle service," states the report, "was demonstrated during the past winter and spring when unusual conditions developed in a number of the larger cities as the result of severe storms, strikes of express and railroad employees, and the action of express companies in placing embargoes on the acceptance of packages under a certain weight.

"Through such improvement of the highways and their use in the transportation of foodstuffs it would be possible to convey an average of not less than 1,800 lb. a day per route, as compared with 24 lb. at present conveyed."

Motor Truck Transportation[*]

By FRANCIS W. DAVIS[†]

(Continued from January 19)

B. F. Fitch, President of the Motor Terminals Co., of New York and Cleveland, estimates that the installation of a terminal system in New York City similar to that of Cincinnati would save $45,000,000 in freight costs yearly. It is reported to cost $35.00 to deliver a car in Manhattan after it reaches the Jersey terminal, while in Chicago it costs approximately $10.35, and in a smaller city like Binghamton, N. Y., $1.80. These are mentioned merely to indicate the great margin for possible savings.

In its terminal work at St. Louis, the Columbia Terminals Company has a transporting operation similar to that at Cincinnati. Instead of using the unit-container detachable body, they use a tractor and trailer, with a fifth wheel and automatic coupling device, permitting great flexibility of operation without necessity for the overhead electric hoists used in Cincinnati, and the transportation of 8 to 10 tons, instead of 5, on each movement.

The railroads are wary of "store door delivery" because they fear that this may be harnessed on them without adequate increase in rates; and, furthermore, they have not at present the equipment nor the organization to undertake the work. Store door delivery, however, is fundamentally sound and represents an ideal toward which we should strive. The motor truck offers the solution to this problem.

In the carrying of passengers the motor truck or bus is taking its place as a feeder to the street railway in facilitating extensions beyond existing lines into urban or suburban territory. The motor bus should supplement and not compete with the street railway, very much as the motor truck supplements the railway.

Bus traffic has reached large proportions. In 1918 the General Omnibus Co. in London carried a total of 682,000,000 passengers against 699,000,000 on the underground and 992,000,000 on the street railways. The London buses carry more passengers than all the surface railway lines of the boroughs of Manhattan and the Bronx in the City of New York.

Bus advocates do not look for the elimination of the street railway. To quote Mr. George A. Green, General Manager and Engineer of the Fifth Avenue Coach Company: "The theory that the car systems in any one of the large cities can be supplanted by a standard size of bus now obtainable is absurd and not worth any serious discussion." Irresponsible bus companies have endeavored to compete with street railways by operating only during the rush hours and handling the cream of the traffic, the short haul patron. It is only fair to the street railways and to the public to submit bus operation to the same control and regulation as to the street railway. In fact, it may be that the bus companies will ultimately be operated by the street railway, as expressed by Walter Jackson, as follows: "There is more than abundant proof that the one way to use the motor bus in the manner most beneficial to the public is to operate it in conjunction with the car service, but with as little duplication and overlapping of routes as possible. Necessarily this implies operation under one management if not one ownership."

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[*] Paper presented at the 41st annual meeting of the American Society of Mechanical Engineers, New York, N. Y., Dec. 6-8, 1920.

[†] Engineer, Pierce-Arrow Motor Company.

There is another field of service in which the motor truck is not in competition with other forms of transportation, the so-called "combination service." The truck engine, used primarily for transportation, is available for auxiliary purposes, and increasing use is being made of it for loading and unloading operations, the driving of winches, cranes, pumps, etc. and for miscellaneous power requirements. As an instance of such equipment, New York City, this winter, will have a fleet of caterpillar tractors operating snow plows for use in snow removal. Approximately 50% of the larger trucks are equipped with some form of auxiliary device utilizing the power of the engine. This is possibly the most interesting phase of the development of the motor truck and each new application opens wide a new field.

Present Status of Truck Transportation

There are, in round numbers, in the United States: 15,000 mi. of canal and inland waterways; 260,000 mi. of railways, and 2,500,000 mi. of highways, outside of municipalities. Approximately 12% of the highways, or about 300,000 mi., are classed as surfaced roads, and would be considered available for motor traffic. Improvements in the design of trucks, however, are permitting their use on roads heretofore considered impassable.

About 2,504,000,000 tons of freight were moved by the railroads in 1918. No corresponding figure is available for the motor truck traffic. There are approximately 800,000 trucks in operation. If each of these averages 5 tons per day for 300 working days per year the total tons moved by truck would be about 1,200,000,000. This is of course only an approximate estimate—there is great need for accurate statistics on motor transportation similar to that available for the railways.

Truck operating costs vary so with conditions that general averages are almost useless as a guide for specific cases. To be of value data must cover the specific class of truck in mind and apply to the same general conditions. The following analysis, however, is given as a typical example.

The Firestone Company presents the following figures covering the analysis of a number of fleets of from 1 to 40 trucks, all of 5 tons capacity. The daily mileage of each truck averaged 40.5 mi.

Cost Item	No. trucks averaged	1919 cost per day	% of total cost
Gasoline	124	$3.42	13.1
Lubricants	113	0.42	1.6
Tires	114	2.29	8.8
Repairs & Overhaul- Labor	127	2.90	11.1
Material	127	2.21	8.5
Driver's wages	113	4.96	19.0
Supervision & Overhead	113	1.74	6.7
License	113	0.11	0.4
Garage	113	0.74	2.8
Insurance	113	1.25	4.8
Interest	114	0.76	2.9
Depreciation	114	5.29	20.3
Totals		26.09	100.0

The labor represents approximately 37% of the total cost, and is about an average figure prevailing in truck operation.

As a step toward securing useful statistics on motor truck operation the general adoption of a standardized cost system would be of great help.

The principles of operation of motor trucks are parallel to those of railway operation. The motor truck owner is confronted with the L. C. L. shipment, which in his case becomes the L. T. L. shipment. Due to the extremely short haul of the motor truck, as compared with the railway, the loading and unloading time becomes of very great consequence.

On a 6-mi. haul a 5-ton truck, with loading time plus unloading time of 60 minutes, would take approximately 95 minutes per round trip and make approximately 6 trips per day. By reducing the loading and unloading time to 5 minutes, the truck should make 20 trips per day, an increase of 300%.

As the haul grows shorter, the importance of reducing the loading and unloading time becomes still more accentuated. For a 1-mi. haul, with 60 minutes loading plus unloading time, the truck accomplishes 9 trips per day. With a 5-minute loading and unloading time, the number of trips is increased tr 60, or 660%. With a further decrease of the loading and unloading time to one minute, which is quite possible, the number of trips increases to 90, an increase of 1000%. The increase in the number of trips increases the tons handled and lowers the cost per ton.

A horse team is limited to approximately 20 mi.

(Continued on page 81)

EQUIPMENT—TRADE—MATERIALS

Snow Removal in New York City

Members of the Police, Fire and Street Cleaning Departments Operate Equipment

Because of the tie-up of traffic in New York City last winter by snow-bound streets, the city has purchased a large amount of snow fighting equipment to meet the emergencies of this and future winters. Included in this equipment are 210 5-ton motor trucks, 100 2-ton trucks, 150 4-wheeled plows, 150 tractors and considerable other equipment.

As soon as the snow begins to fall, the equipment is called out and snow removal work commenced. The police, fire and street cleaning departments are organized into emergency squads to operate the equipment. Each squad consists of four men, two men for day duty and two for night. The squads have been assigned to work certain definite routes and the tractors drawing plows will work in pairs, cleaning a width of 20 ft. at the rate of 3 mi. per hour. A new fire signal, "14-14," is established to call out the emergency squads.

In addition to the city equipment, there is an auxiliary force of about 100 motor trucks hired to draw snow plows. It is estimated that the equipment of the city can take care of 600 mi. of streets and that the hired trucks can take care of an additional 100 mi. Laborers are also employed to pile the snow and load it into trucks. These laborers are registered so that they report to the 103 service stations in the city promptly upon the fall of snow. Here they receive shovels, picks and pan scrapers and are assigned to work by squad leaders.

The sewer system of the city is utilized so far as possible in the work of snow removal and plows attached to the tractors and trucks are used to push the snow to sewer manholes whenever possible.

White trucks, "Caterpillar" tractors, Cletrac tractors and a Friedman mechanical snow loader form part of the equipment to be used in snow removal.

Osgood Railroad Ditcher

A 16-page catalog describing Osgood railroad ditchers has recently been issued by the Osgood Company, Marion, O. The book contains a detailed description of the ditcher and is profusely illustrated by reproductions of photographs of the machine and its various parts and of work in progress.

"What Is Your Highway Problem?"

A handsomely bound portfolio entitled "What is your Highway Problem?" has been issued recently by the Asphalt Sales Department of the Texas Company. The portfolio describes the construction of various asphaltic pavements, including sheet asphalt, asphaltic concrete and asphalt macadam. In addition, it describes the use of asphaltic road oils, asphalt fillers, asphalt for resurfacing and asphalt for surface treatment. It also contains a descrip-

NEW YORK CITY POLICEMEN LEARNING TO OPERATE HOLT "CATERPILLAR" TRACTORS FOR USE IN SNOW REMOVAL WORK tion of Texaco highway service and a list of Texaco products. The portfolio is fully illustrated by reproductions of photographs, drawings and cross sections and may be obtained free from the Asphalt Sales Department, of the Texas Co., 17 Battery Place, New York, N. Y.

Asphaltic Oil and Sand as a Protective Mat on Bridges

By A. A. RUSSELL*

Bridge maintenance is one of the problems of highway administration which receives less attention than any other problem; yet it is one of the most important phases in the upkeep of our highways. Many excellent roads lose their attractiveness because the bridges which span the waterways and railroads are in poor condition. It is not a matter of new construction, either, in many cases, but simply a case of repair and maintenance of these bridges.

BRIDGE AT SOUTHAMPTON, L. I., TREATED WITH TEXACO ROAD OIL AND SAND

Often a deteriorated bridge not only furnishes a rough riding surface, but, because of its run-down condition, it is impossible to keep the road surface immediately joining the bridge on an even plane with it. That is, loose boards next to the road result in the road surface breaking up and cause holes and ruts to occur. Many an automobilist will recall, but not with pleasure, the necessity of slowing down when he comes to a bridge, and even at 10 mi. an hour, getting a disagreeable bump. Many also will recall getting a puncture from a loose nail or spike in the bridge surface. For these reasons, and still again for insurance of safety to travelers, bridge maitenance should receive careful scrutiny. But all the attention should not be given to new construction, the cost of which may be prohibitive at the time the improvement is necessary. Any suggestions to highway administrators in regard to keeping their bridges in shape seem to be desirable; therefore, we shall consider a form of bridge maintenance which has been successful in Southampton, Long Island.

When the plank surface on a bridge spanning a creek deteriorated to the extent that it needed repair, the idea was conceived of placing the planks, which were 2x4 in., with the 2-in. side upright, instead of placing broad side up, as is done in most cases. The planks were pounded close together and spiked thoroughly to prevent slipping, and along the sides they were braced by heavier planks, on which was constructed an iron railing. Then a method was devised to preserve the plank from hasty deterioration as the result of weather and traffic.

The planks had been placed so close together that the cracks between them were very small. This made it possible to spread a small amount of light sand gravel over the planks. After this was done, a coating of road oil containing approximately 55% of asphalt was spread over the sand. The results were highly satisfactory. The volatile oil, which acts as a carrier in the asphaltic oil, penetrated the planks slightly, but enough to make them waterproof. The asphalt bound with the sand almost in the identical manner in which it so efficaciously binds on dirt roads.

Traffic did the rest, and soon a protective mat was formed. This mat not only reduced the impact of vehicles on the planks, but has been withstanding hot and cold weather conditions and preserving the planked surface of the bridge.

T. L. Smith Company Moves Sales Offices to Milwaukee

The T. L. Smith Company, whose sales offices have been located at 470 Old Colony Bldg., Chicago., Ill., has moved the entire department with personnel to Milwaukee, Wis., where the factory of the company is situated.

"Brobdingnagians of Industry"

A folder bearing the above title has been issued by the Austin Machinery Corporation, Chicago, Ill. In it is described the line of earth moving and concrete mixing equipment manufactured by that company. Views of trenchers, cranes, backfillers, steam shovels, etc., are shown in operation on various jobs

Goodyear Tire & Rubber Co. Reorganizes

The Goodyear Tire and Rubber Co. will have an authorized capital of $100,000,000 in 7% preferred stock under the reorganization plan of the company.

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*Eastern Division, Asphalt Sales Department, The Texas Company.

Not more than 1,500,000 shares of common stock, with no par value, will be issued. Stockholders will be asked to authorize an issue of 25-year 8% bonds or notes in sum not to exceed $50,000,000.

Austin Machinery Corporation Absorbs Fairmont Machine Company

The Austin Machinery Corporation, Chicago, Ill., has taken over the Fairmont Machine Co., Fairmont, W. Va. The Fairmont plant will continue to make its own line of machinery, besides contributing to the manufacture and distribution of the Austin line of earth and concrete machinery.

Catalog of Gurley Engineering Instruments

The 31st edition of the Gurley catalog of engineering instruments has recently been issued. This book contains 267 pages and describes and illustrates in detail the Gurley line of transits, levels, stadia and leveling rods, and other engineering and scientific apparatus. Copies may be secured by addressing W. & L. E. Gurley, Troy, N. Y.

Catalog of Engineers' and Surveyors' Supplies

A 40-page catalog of engineers' and surveyors' office and field supplies has recently been issued by the C. F. Pease Co., Chicago, Ill. It lists drawing, profile and cross-section papers, tracing cloth, blue print papers and blueprinting machines, transits, levels, poles, etc. Prices and descriptions are given of the items, most of which are illustrated.

Traffic Counts in Various States—IV

(Concluded from page 63)

South Dakota

Except in a few isolated cases no traffic counts have been made.

Tennessee

No general traffic counts have been made, but fairly accurate counts of traffic on special road projects are attempted.

Texas

No traffic counts have been taken by the State Highway Department. The data that have been collected have been secured through the county engineers, the counts extending from 7 a. m. to 7 p. m.

The classification of vehicles is as follows: 1-horse, loaded, unloaded; 2-horse, loaded, unloaded; 2 or more horse, loaded, unloaded; runabout; touring car; motor truck. Also the record provides for information regarding the type of road, weight of load, principal commodities hauled, approximate weight and kind of heaviest loads and the width of tires of such vehicles.

Utah

Except in a few isolated cases no traffic counts have been made.

Vermont

Except in a few isolated cases no traffic counts have been made.

Washington

The State Highway Department has requested the county engineer or the maintenance engineer to report the daily volume of traffic on each section of primary highways. Single day's traffic is to be counted during the period of greatest highway travel. Traffic stations are to be located at junctions, making a count upon two roads at once. The counts are to extend for one day for the full 24 hours.

The classification of vehicles is as follows:

1. Motor vehicles: (a) Motorcycles; (b) touring cars; (c) trucks (up to 2 tons); (d) trucks (over 2 tons); tractors, etc. (over 5 tons). Tonnage stated refers to trucks only, regardless of loads.
2. Animal-drawn vehicles: (a) Carriages and light wagons; (b) stages and freight wagons.

West Virginia

Except in a few isolated cases no traffic counts have been made.

Wisconsin

Traffic counts have been taken at 100 stations throughout the state for the past three years (1918, 1919 and 1920). The traffic record was divided between Wisconsin cars and foreign cars, trucks, motorcycles, and horse-drawn vehicles.

The counts began at 6 a. m. and continued until 11 p. m., and were made through cooperation with county organizations. The tally sheets show the hourly variations in the traffic. The observation points were selected by the State Highway Department, near cities on the heavier traveled roads within a county. During 1919 counts were made four times a month on different days of the week. In 1920 counts were made twice a month.

The purpose of the census was primarily to determine the traffic that various types of roads were carrying and the maintenance cost required to keep these roads up to a certain standard.

It is noted that although one man could make the enumerations, at certain stations two men were required and at a few stations four men were necessary.

Wyoming

Except in a few isolated cases no traffic counts have been made.

MEETINGS

Calendar of Coming Meetings

Feb. 7-8.—Florida Engineering Society.—Annual meeting, Lakewood, Fla. Secretary, J. R. Benton, Gainesville, Fla.

Feb. 9-12—American Road Builders' Association.—Eighteenth Annual Convention, Eleventh American Good Roads Congress and Twelfth Good Roads Show under the auspices of the A. R. B. A., The Coliseum, Chicago, Ill. Secretary, E. L. Powers, 11 Waverly Place, New York, N. Y.

Feb. 11-12.—Engineering Society of Wisconsin.—Annual meeting, Madison, Wis. Secretary, Leonard S. Smith, Madison, Wis.

Feb. 14-16—American Concrete Institute.—Annual meeting, Auditorium Hotel, Chicago, Ill. Secretary, Harvey Whipple, Detroit, Mich.

May 9-11.—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

Illinois Society of Engineers

The 36th annual meeting of the Illinois Society of Engineers was held on Jan. 26, 27 and 28 at the Great Northern Hotel, Chicago, Ill. The fourth session on the morning of Jan. 27 was devoted to roads and pavements, with H. J. Fixmer, Division Engineer of the Chicago Board of Local Improvements, presiding.

Papers presented at the road and pavement section were, "Significance of Local Conditions in the Design of Brick Pavements," by Maurice B. Greenough, Secretary, National Paving Brick Manufacturers Association; "Relation of Highway Transport Surveys to Economic Highway Improvement," by Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport, University of Michigan; "Contracts and Specifications," by Geo. W. Tillson, Consulting Engineer; "Relation Between Strength and Wear of Concrete," by Duff A. Abrams, Portland Cement Association; "Alignment and Grades for Modern Roads," by R. E. Toms, Senior Highway Engineer, U. S. Bureau of Public Roads; "Street Maintenance in the Small City," by Harlan W. Edwards; Important Details in Constructing Bituminous Pavements," by Hugh W. Skidmore; "The Need of Research in Highway Problems," by Prof. C. C. Wiley of the University of Illinois.

On Friday evening, Jan. 28, the annual banquet of the association was held in the Crystal Room of the Great Northern Hotel.

Society of Automotive Engineers

The annual meeting of the Society of Automotive Engineers was held in the Engineering Societies Building, New York City, on Jan. 12, 13 and 14. At the highway session the following papers were presented and discussed: "Government Highway Research," by A. T. Goldbeck; "Variable Factors that Influence Highway Design," by H. E. Breed; "Automobile Roads," by W. E. Williams, and "The Automotive Engineer's Relation to Highways," by H. W. Alden.

Lincoln Highway Association

The directors of the Lincoln Highway Association held their annual meeting on Dec. 28 at the Detroit Athletic Club and elected the following officers: President, J.N. Gunn; Vice Presidents: Henry B.Joy, F. A. Seiberling, R. D. Chapin; Vice President and Secretary, A. F. Bement; Treasurer, Emory W. Clark; Field Secretary, G. S. Hoag; Directors: Carl G. Fisher, John N. Willys, W. C. Durant, A. Y. Gowen, Sidney D. Waldron, Alvan Macauley and W. O. Rutherford.

Kentucky Highway Contractors' Association

The Kentucky Highway Contractors' Association was formally organized at a meeting at the Seelbach Hotel, Louisville, Ky., on Jan. 11 and 12. Among the speakers were George W. Bucholz, Secretary of the Associated General Contractors of America; David R. Lyman, President of the Associated General Contractors of Louisville, and Rodman Wiley, former State Highway Commissioner of Kentucky. On Jan. 12 a banquet was held, with Governor Edwin P. Morrow of Kentucky and Joe S. Boggs, State Highway Engineer of Kentucky, among the speakers.

New England Road Builders' Association

The New England Road Builders' Association was organized on Jan. 13 with temporary headquarters at 68 Devonshire St., Boston, Mass. Contractors and persons engaged in the road building industry are included in the membership of the association. Officers were elected as follows: President, Ransom Rowe; Vice President, John F. Coleman; Treasurer, Joseph A. Tomasello; Secretary, Samuel Hobbs; Executive Board: Ransom Rowe, Geo. M. Bryne, C. B. Lindholm, A. A. Adams, C. J. Spalding, C. J. Reynolds, J. J. Welsh, E. J. Bourke

"The object of this association," according to the by-laws, "shall be to harbor the interests of those engaged in construction of roads and work incidental thereto; to promote better relations between private owners and public bodies on one hand and contractors on the other; to combat unfair practices; to encourage methods which relieve the contractor of risk in bidding and contracting for work; to encourage efficiency among road builders and to encourage sound business methods; in all lawful ways to promote and protect the business interests of the members of this association; but there is no intention nor shall there be any action on the part of this association to control or in any way deal with prices, or restrict competition."

Bankhead National Highway Association

The directors of the Bankhead National Highway Association met last month at the Tutwiler Hotel, Birmingham, Ala., and received the report of the secretary, J. A. Rountree. Plans for the fifth annual meeting of the association were discussed and Secretary Rountree spoke upon the recent trip of the motor convoy across the continent over the Bankhead Highway.

American Society of Civil Engineers

The annual meeting of the American Society of Civil Engineers was held on Jan. 19 and 20 in the Engineering Societies Building, New York City, and the following officers elected: President, George S. Webster, Philadelphia, Pa.; Vice Presidents: E. E. Wall, St. Louis, Mo., A. M. Hunt, New York City, Frank G. Jonah, St. Louis, Mo.; Treasurer, Otis E. Hovey, New York City; Directors: J. P. Hogan, New York City, Ira W. McConnell, New York City, R. L. Humphrey, Philadelphia, Pa., B. L. Brown, St. Louis, Mo., F. T. Darrow, Lincoln, Neb., George G. Anderson, Los Angeles, Cal. Mr. Webster, the new prisident of the association, is chief of the Bureau of Surveys, Philadelphia, Pa.

National Conference on Highway Traffic Regulations

Representatives from thirty organizations were in attendance at the National Conference on Highway Traffic Regulations held in Washington, D. C., on Jan. 10, 11 and 12. Although considerable discussion was had on various phases of traffic regulation, little seems to have been accomplished. Harry Meixell, Jr., of the National Automobile Chamber of Commerce, declared that the work of the conference was merely a duplication of the work performed by the Joint Committee on Uniform Traffic Laws, whose proposed uniform law has been widely distributed by the Federal Highway Council.

Commenting upon the conference, John N. Mackall, Chairman, Maryland State Roads Commission, stated, "The purpose of the conference was excellent, but I am afraid that the movement will not get anywhere because of the insistence on the part of the motor truck manufacturers of the right to put excessive loads upon the highways."

Motor Truck Transportation

(Continued from page 76)

per day and to a speed of 3.5 mi. per hour. The team can therefore be "on the road" 5.7 hours. Any improvement in loading and unloading which forces the team to exceed the day's mileage or to cover it in less than the allotted time, would ultimately ruin the team, and accomplishes nothing in economy of transportation. There is accordingly a critical loading and unloading time for the horse team for each radius of haul which permits the team to just cover the full 20 mi. by the end of the day.

No such limitation exists for the motor truck, as an engine needs no rest periods and the advantage of improvement in loading and unloading facilities may be utilized to the utmost.

The question of possible increase in size of motor trucks is an economic one. There is no mechanical limitation preventing a considerable increase in carrying capacity, but if the size increases much beyond the present maximum of 5 to 6 tons capacity, the vehicle becomes unmanageable, and the inability always to operate at capacity loads offsets the advantages of large size units. The weight, too, would exceed the carrying capacity of many of the present highways and bridges.

The development of the motor truck is intimately related to the rubber tire. The function of the tire is to increase traction, to absorb road shocks, and to protect the highways. The pneumatic tire promises betterment in all three functions. It must prove itself, however, to be economically desirable before it will be generally adopted. The advantages claimed for the pneumatic tire are as follows: (a) Greater traction; (b) more cushioning; (c) higher speed; (d) lower repair bills; (e) saving in gasoline; (f) more work possible.

As against these, the pneumatic tire costs more than the solid tire and has a shorter life. It is subject to punctures while the solid tire is not. High speed operation is obviously an advantage but an increase in the operating speeds now permitted in cities hardly seems likely. The opportunity for increased speed lies in interurban and open country work.

(To be concluded)

More than 10,000 firms are engaged in motor truck hauling in the United States, according to a recent estimate. Some of these firms have over $1,000,000 invested.

PERSONAL MENTION

C. W. Hughes has been appointed city engineer of Port Arthur, Tex.

Harry Thourot has been appointed town engineer of Union Hill, N. J.

Edward S. Clark has been appointed city engineer of Kalamazoo, Mich.

Harry W. Nolen has resigned as county engineer of Travis County, Texas.

Robert A. McClenahan has been appointed city engineer of Astoria, Ore.

C. N. Beazley has been appointed assistant city engineer of Port Arthur, Tex.

Philip H. Shaffer has been appointed engineer of Somerset County, Pennsylvania.

W. E. Selby was recently appointed assistant engineer of Tarrant County, Texas.

A. A. Pomper has been appointed assistant highway engineer of Monroe County, Missouri.

I. W. Lee has resigned as general secretary of the Theodore Roosevelt International Highway Association.

O. E. Parks has been appointed superintendent of highways, sewers and waterworks of Westfield, Mass.

John M. Malang, State Highway Superintendent of Missouri, has resigned to enter the contracting business.

D. W. Stevenson has been appointed a member of the Florida State Road Department to succeed Edward Scott.

Manuel C. Cutler has been appointed superintendent of the Department of Bridges and Public Buildings of Milwaukee, Wis.

T. S. Brindle, Chief Engineer of the Ohio State Highway Department, has been made temporary state highway commissioner.

T. R. Spence has resigned as division engineer of the Texas State Highway Department and is now engineer for Webb County, Texas.

J. N. Carlisle, formerly State Highway Commissioner of New York, was recently elected president of the Northern New York Utilities.

E. W. Sylvester recently resigned as city engineer of Poughkeepsie, N. Y., and is now with the Pennsylvania State Highway Department.

John N. Mackall, Chairman of the Maryland State Roads Commission, has resigned as a member of the Subgrade Committee of the Federal Highway Council.

R. B. Murdock has resigned as engineer for the Asphalt Association and now represents the F. D. Cummer & Son Company. Mr. Murdock has offices at 19 W. 44th St., New York City.

Patrick Philip has been appointed Chief Engineer of the British Columbia Department of Public Works, succeeding A. E. Foreman, who recently resigned to go with the Portland Cement Association.

Frank B. Dunn, President of the Dunn Wire-Cut Lug Brick Co., Conneaut, O., was recently elected president of the Consumers' Gas Company, of that city, which took over the Northeastern Oil & Gas Co.

Herbert S. Sisson of Collins, N. Y., has been appointed state highway commissioner to succeed Col. Frederick Stuart Greene, the present incumbent. Mr. Sisson, who was excise commissioner of the state assumed his new duties on Feb. 1. He is appointed for a 3-year term, at a salary of $10,000 a year. Mr. Sisson's first public office was that of supervisor of the Town of Collins. He was then appointed to fill a vacancy as county superintendent of the poor of Erie County, later being elected to that office. He was appointed excise commissioner by Governor Whitman in 1917.

State Senator James H. MacDonald will head the Roads, Bridges and Rivers Committee of the upper house of the Connecticut Legislature for the next two years, according to a recent report concerning the committee appointments made by the presiding officers of the Legislature. No finer acknowledgement of Senator MacDonald's services to the state could be made by the Legislature at this time and his many friends among the readers of GOOD ROADS will learn of it with unusual pleasure. He was the state highway commissioner of his state for nearly two decades, during which he earned a national reputation for fearlessness and ability.

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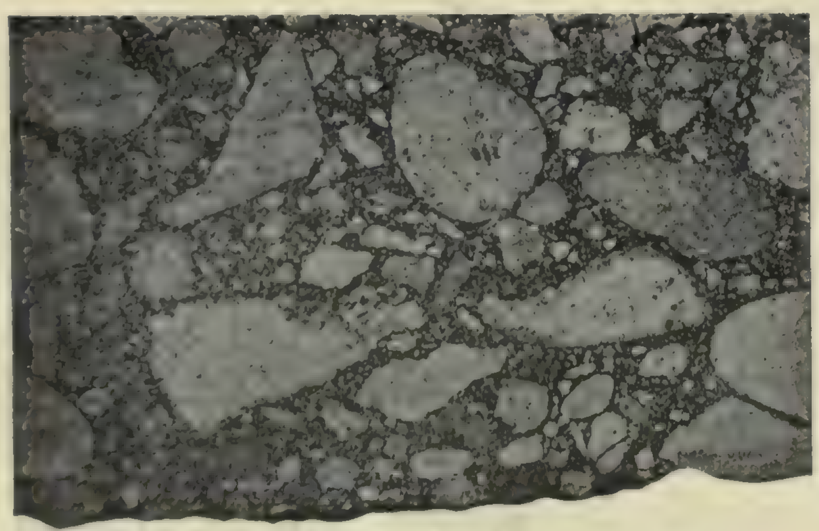

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JAMESTOWN, N. Y., FEBRUARY 9, 1921

Number
6

Bridge Development in Kansas*

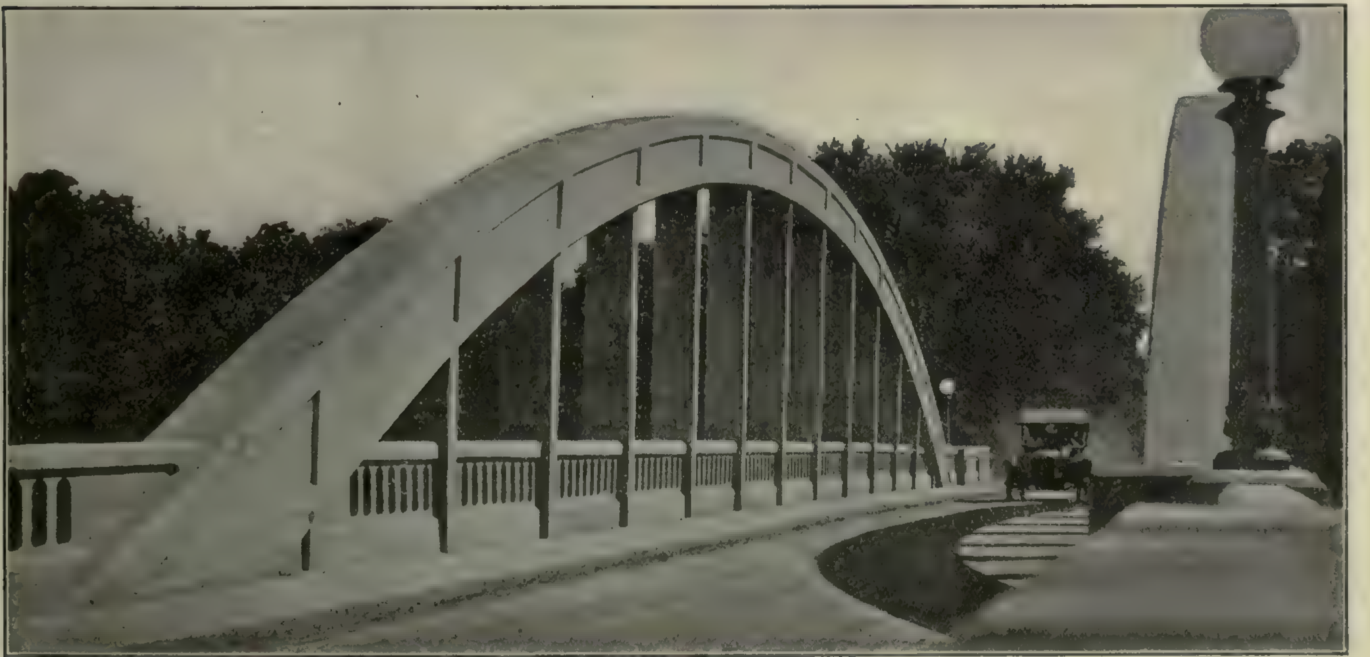
By F. W. EPPS†

Twenty years ago the popular type of bridge in Kansas was the steel truss span supported either on masonry or concrete abutments. These trusses have been neglected and allowed to rust out at vital points until they have failed under the modern heavy loads over them..

With the development of the cement industry, the price of cement, until recently, has been lowered and the quality improved, until some five years ago concrete structures were cheaper and far better than steel ones. This period of cheap concrete bridges taught the public the advantages of this type of structure and they are now unwilling to go back to the old types.

Many types of bridges are used in Kansas, but by far the most common is the concrete one, of either the slab or the T-girder span, as the size requires. In some counties steel spans have been used for the longer bridges, but always with a concrete floor. Other counties are more progressive and use the higher types, such as the through girder or the arch.

The same trouble is experienced in highway loadings that we have in railway loadings. The loads are constantly increasing and old structures are becoming obsolete and too light for modern trucks. This is shown in railroad work by the numerous replacements which are being made by the larger railroads, many of which are made on bridges that are apparently in good condition, but not heavy enough to carry modern loads. Our truck loads are increasing as rapidly as railroad loads and at present we



SOLDIER CREEK BRIDGE, TOPEKA, KANSAS—RECENTLY COMPLETED—REINFORCED CONCRETE ARCH OF 140 FT. SPAN find that there are in the neighborhood of 30 tractors in Kansas which have a capacity of 20 tons, the heaviest loading specified by the State Highway Commission for designing bridges in the state. This would indicate that it will be only a matter of time before the present bridges will be depending on their factor of safety to carry the loads and new bridges will have to be designed for a heavier loading.

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*Paper presented at a recent meeting of the Kansas Engineering Society.

†Bridge Engineer, Kansas Highway Commission.

A short description of some of the larger bridges erected in Kansas during the past year will be of interest.

The Sterling Bridge in Rice County is located on a federal aid road leading from Hutchinson to Lyons. This is one of the largest bridges recently built in Kansas and consists of eleven 40-ft. T-girder spans. It is worthy of note in this connection that the majority of concrete bridges built in Rice County have 20-ft. roadways. This bridge has a 24-ft. roadway, being more important than any of the others, and showing that the county is looking forward to the time when traffic will require wider bridges.

The Spring Valley Bridge in Cherokee County has recently been let and construction will start shortly. This bridge consists of three 160-ft. spans with an 18-ft. roadway and is located on a federal aid road between Galena and Columbus. Conditions at this bridge are bad, as it is located above a dam and a great depth of water and mud is encountered. This bridge also includes a smaller bridge known as the Slough Bridge, consisting of three 50-ft. T-girder spans, crossing a branch of the river and located only about 150 ft. from the main bridge.

The Fischer Bridge in Anderson County is located on a federal aid road leading from Garnett to Ottawa. This bridge consists of a 120-ft. arch span with two 50-ft. approaches. This arch bridge is one of the highest in Kansas and will make a very beautiful structure, as its location is such as to give it a fine scenic setting.

Two large bridges have been contracted for in Cowley County, one an arch bridge in Winfield and the other a girder bridge at Arkansas City. Work on the former has just begun, but the latter is nearly completed.

A rainbow arch is being built in Geary County at Junction City, with a 150-ft. span. This is one of the largest arches of this type ever erected in Kansas.

The Flat Rock Bridge in Neosho County consists of three 60-ft. arches. Work has just begun on this structure.

Osage County recently let contracts for two large bridges. The Salt Creek Bridgee has three 35-ft. T-girder spans and the 110-Mile Creek Bridge has three 50-ft T-girder spans. Work is well under way on these bridges.

The contract has recently been let for a 130-ft. Marsh arch near Wakarusa in Shawnee County. This bridge will have particularly high abutments.

Several other counties have done considerable bridge work during 1920, notably Butler, Dickinson, Montgomery, and Harper Counties.

The total amount of bridge work approved by the State Highway Commission up to Nov. 1, 1920, was $1,430,371, while the total amount of bridge work approved since the commission started has been $3,603,569. The average cost of concrete bridges in Kansas during the past year has been $30.69 per cubic yard. This price covers culverts as well as bridges.

Motor Truck Transportation—III*

By FRANCIS W. DAVIS†

(Concluded from February 2)

Improvement of Truck Transportation

In the early days it was necessary for trucks to have good roads and avoid steep hills. The ability of the modern truck to meet difficult road conditions is not generally understood. Today, a good truck will grind its way over poor roads offering a resistance as high as several hundred pounds per ton, and up grades as steep as 20%. But good roads are necessary for economy and the improvement of highways is of paramount importance in the development of truck transportation.

In 1918, J. E. Maloney of the State Highway Department of Colorado in an investigation of the 113 roads constituting the state highway system of 3,827 mi., gave the following conclusions:

"Taking the traffic for the 3,287.6 mi., estimated in the tables published in December as 162,926,098 ton-miles, and applying the average cost, as given in the operating costs, of 10.8 ct. per ton-mile, will make $17,595,917 per year as the operating cost for the traffic alone.

"A saving of but 1 ct. per ton-mile on this traffic would equal $1,629,261 annually, which sum capitalized at 5%, would warrant the expenditure of $32,585,200 in the improvement necessary to effect this annual saving.

"From a gravel to a paved road there would be an average saving of 1.1 ct. per ton-mile so that an annual traffic of 95,000 or more ton-miles per mile of road would justify an expenditure of $21,000 per mile for the improvement."

If such savings are obtainable in a sparsely settled state, such as Colorado, proportionately greater savings should follow road improvement in the more densely settled section where traffic is much heavier.

Proper surfacing and foundations are the greatest need. Grades are of very little importance if these are right. It will be necessary, however, to have bridges of ample capacity to take maximum loads.

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*Paper presented at the 41st annual meeting of the American Society of Mechanical Engineers, New York, N. Y., Dec. 6-8, 1920.

†Engineer, Pierce-Arrow Motor Company.

To realize the possibilities of highway improvement there must first be education. A conference on "Highway Engineering and Highway Transport Engineering," held in Washington, D. C. in May of this year recommended an immediate increase in the engineering staff of our technical schools and colleges, and the preparation of 900 college trained civil engineers in addition to the highway engineers now employed by counties and municipalities. It further recommended that certain schools and colleges furnish short graduate courses in highway engineering and highway transport engineering for men capable of assuming responsible positions in this field. The University of Michigan is prepared to undertake a series of such short courses, and other colleges and schools are rapidly falling in line.

The matter of research is also of vital importance. Under the National Research Council, a Highway Research Committee was recently formed for the purpose of studying: (a) The economic theory of highway improvement; (b) structural design of roads; (c) character and use of road materials.

The Bureau of Public Roads, Department of Agriculture, is conducting a series of tests on the relative impact of solid tires and pneumatic tires on motor trucks under all conditions, and also making a study of the relative wearing qualities of different types of pavements and subgrade materials. This work will have an important bearing on the road construction and truck operation of tomorrow.

The ideal in highway development is a comprehensive system of national highways under Federal control. The Townsend Bill calls for a system to be built and maintained under the supervision of a Federal Highway Commission. This bill calls for an eventual expenditure of $425,000,000, to be spread over five years.

It has been charged that motor transportation is subsidized by the public funds spent in maintaining highways, while the railways have no such aid. The same point can be made in connection with waterways, but the motor vehicles unlike the waterways are contributing millions of dollars annually in the form of license fees as their contribution to the increased wear of the highways. Improved highways like improved waterways benefit the general public as well as truck owners, and all are free to use them.

The conflicting, in fact chaotic, state legislation with its varying restrictions as to size and weight, registration fees, etc., must not be overlooked. Both motor transportation and the highways should be protected by reasonable legislation. The actual facts should be placed before the legislatures to aid in the formulation of laws just to all concerned. The Motor Vehicle Conference Committee, representing the principal motor vehicle associations outlines the situation as follows:

The Corner Stones for Proper Motor Vehicle Legislation

First: Those concerned and interested in the motor vehicle, after giving thorough investigation and consideration to all the factors involved and with due regard for the public interest, must work out and set forth scientific and equitable principles which should be at the base of all laws dealing with the motor vehicle.

Second: These scientific and equitable principles must then be placed before the people of the forty-eight states of this Union in such a way that the public will see the need of and demand the adoption and application of uniform motor vehicle laws in conformity with them.

Third: After these scientific and equitable principles have been established as the sound and just foundations for motor vehicle laws of the United States, every effort must be made to preserve them from unwarranted disturbance, and to modify, add to or expand them intelligently as conditions require.

To sum up briefly:

Railway transportation should and will hold its place for long hauls, and for carload shipments where there is direct railway connection to the factory or warehouse of the shipper.

Motor transportation will relieve the railroads of the expensive short haul, serve them at terminals, and widen the zone tributary to the railroads throughout their entire length.

It will supplement the street railways.

It will spread into a wide field where the engine's power can be utilized for auxiliary purposes.

With the steady improvement of devices for shortening the loading and unloading time there will be a reduction in the use of horses for heavy freight haulage.

The economic limit of the size of motor trucks will probably remain about as at present, although the use of trailers will increase the tons hauled per movement.

The use of motor trucks will increase with the general improvement of the highways.

The motor industry will welcome sound and uniform legislation and aid in securing it.

———ooo———

Hillsborough County, Florida, constructed 26 mi. of road last year from the proceeds of an $850,000 bond issue. Approximately 22 mi. of road remain to be finished with this fund.

Lucas County, Ohio, plans to spend $300,000 on road improvements during 1921, according to County Surveyor Rood.

St. Louis County, Missouri, will sell $280,000 of road bonds in accordance with a court order authorizing such action. The bonds to be sold are a part of the $3,000,000 issue voted in February, 1916, bearing 4½% interest and are tax exempt.

A Review of Road Building Problems[*]

By PAUL D. SARGENT[†]

There has never been a year since the beginning of systematic road improvement in this country when so much was expected of the road building organizations and when so little, comparatively speaking, has been accomplished. We were all proud a year ago to announce that more than $600,000,000 would be available from federal and state sources for road construction programs in 1920. The war had been brought to a successful termination; industries converted to the manufacture of war materials were closing down and had not resumed peace-time production; a large supply of labor seemed to be in sight, and state highway departments were bending every energy in preparation for the greatest year's program in their history. Contracts were let in the fall of 1919 and during the first four months of 1920 in order that the contractors could have the opportunity to get construction work under way at the earliest possible date.

By May or early June it was apparent that our hopes were not to be realized. Prices bid for work were extremely high and at each successive opening of bids prices increased. New York, I believe, was the first state to revise its scheme for a large program of construction by announcing in May that no more work would be let until prices became stabilized, but that every effort would be made to secure the completion of unfinished contracts of earlier years, and to carry out their projected maintenance program. Shortly thereafter many other states reduced their construction programs to cover only 20 to 25% of the work originally planned for the year.

I have no data on conditions throughout the country, but it is my belief that not over 25% of the projected plan of highway construction has been carried out.

It was soon learned that there was a shortage everywhere of labor for highway work and that wages were as high as, and in many cases higher than, had ever before been paid. We also learned that it would be difficult to secure construction materials or equipment requiring rail haul. One case may serve to illustrate difficulties of this kind. I had a contractor who ordered a construction outfit in May with a promise of delivery June 15. The plant was ready for delivery at that time, but the railroad would not handle it and delivery was actually made in September, a part of the haul on each end being made by motor truck.

On account of conditions, and to appease the public demand for highway construction, resort has been had to various methods of carrying on work. Contracts have been let on a cost plus percentage basis, on a cost plus fixed fee, with and without bonus, and much work has been undertaken on a straight force account basis. Many departments have entered into construction arrangements which would never have been countenanced under normal conditions. In many cases types of construction have been changed from those originally planned, because it was impossible to secure materials to carry out the work as designed.

In my own state we have constructed several roads with a gravel surface, from local deposits, where we had planned to build bituminous macadam. We have also built subgrades, culverts, etc., on several jobs, hoping to lay the pavement in 1921. These improvements will give immediate relief where conditons have previously been bad.

We have all been disappointed at our accomplishments in actual road construction, but I believe that the fact that we have been unable to spend more money will prove to be a blessing in disguise. Delayed construction, in my judgment, will mean better and less expensive construction.

Because of the inability of the railroads to carry freight offered, there has occurred a very heavy movement of commodities over the highways. If trucks had not been available for this traffic, many lines of business would have been forced to suspend operations entirely, both from want of raw material and from inability to deliver finished products to consumers. The results of this traffic many of you realize better than I do. In May last I saw a large collection of photographs taken in many states showing failures of all modern types of pavements, many of which were constructed in 1919, presumably in accordance with the best practice then existing. The direct result of these road failures has been to bring about an intensive study of subgrade problems and a study of the amount and effect of impact upon pavements.

Intensive trucking has proved disastrous to many miles of every kind of highway pavement. Road builders have long said that they should not be blamed for failures if they could not know in advance of construction what loads were going to be brought upon the completed highway. The situation existing today, it seems to me, is analagous to the owning, constructing and maintaining of a railroad by a company who will have nothing to say about the type, character, design or weight of rolling stock and motive power that would be allowed to operate over the

(Concluded on page 88)

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[*] Extracts from presidential address delivered at the sixth annual convention of the American Association of State Highway Officials, Washington, D. C., Dec. 13-16, 1920.

[†] President, American Association of State Highway Officials; State Highway Engineer of Maine.

GOOD ROADS

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HIGHWAY ADMINISTRATION IN NEW YORK STATE

A radical change in the method of administering highway work in New York State will be made if the present Legislature acts upon Governor Miller's recommendation that the three offices of state engineer, superintendent of public works and commissioner of highways be consolidated.

If such action is taken, the state will go back to something like its original plan. New York was the fourth state to adopt the state aid principle of highway improvement. That step was taken in 1898 by the passage of the Higbie-Armstrong law which placed the control of road work, so far as the state exercised control, under the state engineer and surveyor. Successive legislatures amended the highway laws and during the years since the inauguration of state aid the work has been administered at different periods by a three-headed commission and by a single commissioner, as at present.

Highway authorities hold many different views as to the best plan of administering state road work and several different plans are in operation. If New York work is to remain under the direction of a single head, there would appear to be no good reason why that head should not be the state engineer, especially in view of the undoubted ability of the present incumbent of that position. The one objection that is most obvious is that such disposition of the control will perhaps tend to make the administration of highway work somewhat less removed from danger of political interference, for the office of state engineer is an elective one.

A FLEXIBLE INTEREST RATE ON ROAD BONDS

A law permitting a flexible interest rate on road bonds has been asked of the Pennsylvania Legislature by Governor Sproul. In making the request, he pointed out that the legal limitation of interest rate has militated against the selling of the sate's issues and urged the importance of the proposed measure as a means of expediting the highway betterment program of the commonwealth.

This action would seem to be an obvious and effective remedy for the situation that has confronted many of the states during the past year or so. With gilt edged securities selling at prices to yield 6, 7, and even 8%, it has been increasingly difficult to dispose of road issues bearing only 4 or 5, and in consequence, many state and county road programs have been delayed.

It is to be hoped that the Legislature will agree with Governor Sproul and enact the needed law.

A GASOLINE TAX FOR ROAD FUNDS

One of the officials of the California State Highway Commission is reported to have come out in favor of a gasoline tax. It is presumed, of course, that the proceeds would be devoted to road work, probably to maintenance.

There is nothing new in this suggestion, but the information at hand does not indicate that it has been adopted and put into practice. As a matter of fact, any such effort would probably cause a storm of protest from those upon whom the tax would fall most heavily.

At the same time, a tax on gasoline would be a much fairer tax upon the use of motor vehicles than is any now in operation. If it is just to levy a tax upon the users of the roads on the theory that those who benefit should pay, it is certainly just to apportion that tax as nearly as possible in proportion to the use made of the highways. A gasoline tax, would meet that specification, to some extent, for the amount of gasoline used varies, approximately at least, as the mileage made and the weight of the car. Sooner or later, some such scheme probably will be applied.

Missouri Studies Possibilities of Making Its Own Cement

State Geologist H. A. Buehler of Missouri has investigated the limestone and shale deposits in several counties in the state and has reported to a committee of the Legislature that the material is suitable for the manufacture of cement. This committee was appointed to study the feasibility of the state's making its own cement for road building.

Bill Proposes Division of Oregon Road Funds with Counties

A bill was recently introduced in the Oregon Legislature by Representative Fisher, providing that beginning in 1922 the state highway funds shall be divided between the state and the counties. Under the provisions of the bill, half of the money would be spent on trunk and main highways by the state and the other half would be divided among the counties of the state for road work to be done under state supervision.

Highway Engineer of California Recommends Gasoline Tax

The state taxation of gasoline is recommended in the annual report of State Highway Engineer Fletcher of California. The suggested tax, the report says, would "automatically distribute itself among those benefiting by the highway in proportion to such use. The suggestion of Secretary of the Treasury Houston that the Federal Government impose a tax upon gasoline would indicate the importance of the early occupation of the field by the state government."

Pennsylvania Will Hold First Letting on February 18

Plans to Contract for 350 Miles of Road Before Opening of Construction Season

The Pennsylvania State Highway Department will hold its first letting on Feb. 18, at which time bids will be opened on approximately 104 mi. of new roadway and the construction of a concrete bridge in North East Township, Erie County. The department hopes, if conditions permit, to put under contract not less than 350 mi. of new roadway before the actual beginning of the construction season. The projects included in the letting of Feb. 18 are as follows:

Allegheny County, 3,606 ft. and 15,556 ft.; Beaver County, 26,974 ft.; Bucks County, 67,069 ft., 36,706 ft. and 27,010 ft.; Clearfield County, 25,426 ft.; Crawford County, 18,514 ft. and 24,787 ft.; Delaware County, 12,077 ft.; McKean County, 6,188 ft.; Northampton County, 34,871 ft.; Northumberland County, 18,957 ft.; Somerset County, 2,998 ft.; Tioga County, 41,843 ft.; Venango County, 50,024 ft.; Warren County, 12,012 ft.; Washington County, 16,137 ft.; Westmoreland County, 6,895 ft.

In the majority of instances the pavements built will be concrete, but on several projects alternate bids are asked for a bituminous surface course on a concrete foundation.

A Review of Road Building Problems

(Concluded from page 86)

road. We can all see that such a condition would quickly lead to chaos and ruin.

The public is becoming incensed over this condition and undoubtedly many of the 42 state legislatures which meet this winter will attempt to pass regulatory measures. I fear that much of the legislation will be based upon prejudice rather than real information concerning the subject.

Overloading and overspeeding are the two underlying causes for most of the damage done to the highways. Both put too great pressure upon the highway surface and excessive speed puts a burden upon the brakes of the vehicle which they are not designed to handle.

I wish we had uniform traffic laws all over the country. One very real difficulty, it seems to me, in realizing this much to be desired condition, is found in the states which for years have been building improved roads and now have a large mileage of roads not sufficiently strong to carry traffic of the extreme weight recommended. However, it is entirely possible for a state to pass a traffic law with special provisions. I am inclined to think that many of the states, if they adopted the uniform traffic law, would have to exempt from its operation many of their principal through lines or else vest in some body authority to so regulate traffic that during the critical periods of the year only traffic of a certain weight would be allowed on these roads. Many roads which can not stand the strain in the spring and the fall will carry the maximum recommended load when the subgrades are dry or frozen.

Undoubtedly the tendency, as truck traffic increases, will be to go to larger units, on account of their more economical operation. It has occurred to me that a considerable economy of operation over present methods of highway transportation can be secured by the use of trailers, which will not increase unit wheel or axle loads, but will materially increase the usefulness of the motor. Rail transportation would never have developed to its present state if each unit of load had been carried on an independent self-propelled vehicle. The railroads have taught us a great many things about road building. We may yet learn from them how to move traffic economically.

Legislature Will Investigate Nevada State Highway Department

The Nevada Senate has appointed a committee of eight, four from each house of the Legislature, to investigate the State Highway Department, with a view to consolidating it with other departments. The committee is allowed a month to report and has the power to summon witnesses.

Flexible Interest Rate Road Bond Law Asked by Governor of Pennsylvania

Annual Message to Legislature Points Out Necessity for Increased Interest

Governor Sproul of Pennsylvania, in his annual message to the Legislature, recommended that legislation be enacted permitting the sale of highway bonds at prevailing rates of interest, not to exceed 6%. He also recommended the early acquisition of all toll roads and bridges in the state.

"I am sure," said the governor, "that we should go ahead actively with our highway improvement until all our main roads have been made available for traffic at all seasons of the year, and through routes established which will provide transportation facilities for all sections of the state.

"We have available more than half of the $50,000,000 road loan, and propose to sell the bonds which we are authorized to issue, and proceed with the work as rapidly as possible. It is a noteworthy fact that the counties of the state have voted upon loans, amounting to over $34,000,000, to cooperate with the state in building highways, and that, in addition to this, there are in sight, through township loans and money which can be spared through temporary county borrowing by the county commissioners, additional sums which will bring the total available from this source up to very nearly $50,000,000.

"Last year, owing to the extraordinary financal conditions prevailing in the country, we found it impossible to secure bids for our state bonds, bearing interest of 4½% fixed by law. However, with the cooperation of the fiscal officers of the commonwealth, we were able to induce a group of patriotic Pennsylvania bankers to purchase $11,800,000 of short term bonds, with the understanding that provision would be made, as soon as possible, for the substitution for this temporary loan of permanent bonds bearing a higher interest rate. It will be necessary to increase the interest rate in the next offering, and legislation should be passed allowing the bonds to be sold at the prevailing rate of interest for securities of the kind, not to exceed the legal rate of 6%. At the present moment, it would probably be possible to dispose of our bonds upon a 5% interest.

"There are sufficient funds available for completing the acquisition of the toll roads upon the state highway routes. We should now turn our attention to acquiring and freeing the toll bridges, of which there are many Tolls of any kind, and especially upon our main routes, do not reflect credit upon our enterprise."

$300,000 Offered for Delaware River Toll Bridge

The New Jersey-Pennsylvania Toll Road Commission, composed of representatives of the two states engaged in purchasing toll bridges across the Delaware River, has offered the Easton Delaware Bridge Company, $300,000 for the bridge at Easton, Pa.

Proposed $60,000,000 Missouri Bond Issue Causes Protest

Protests have been made in all parts of Missouri against the provision of the recent amendment to the state constitution requiring the payment of interest on the proposed $60,000,000 road bonds by a property tax. A conference of legislators and legal representatives of road, civic and commercial organizations and county courts has been called by the attorney general.

University of Maryland Will Conduct Research on Highway Problems

The University of Maryland will conduct a number of experiments on the design and construction of roads, according to A. N. Johnson, Dean of the Engineering Department. These tests will be made with the cooperation of the Maryland State Roads Commission and the U. S. Bureau of Public Roads, and will deal with the bearing power of soils, effect of impact upon various surfaces, cost of operating various types of vehicles over different road surfaces, etc. Traffic counts will also be taken on Maryland roads and road samples in the form of cores will be taken and tested in the laboratory.

Wisconsin Governor Urges Employment of Idle Men on Road Work

Governor John J. Blaine of Wisconsin in his recent message to the Legislature recommended that measures be taken for the employment of 70,000 jobless men in road construction in that state, pointing out that $26,000,000 is available for road work.

"To enter upon the construction of good roads at this time," the governor said, "does not involve the collection of any additional tax, as the money has already been raised and is now idle. I recommend that the Industrial Commission, through the free employment offices maintained by the state, cooperate with the State Highway Commission in absorbing the unemployed in the state as far as possible and practicable."

Road Expenditures of Lambton County, Ontario

During the year 1920, Lambton County, Ontario, expended $114,619 on road construction and maintenance, according to the report of John McCallum, County Road Superintendent.

Bridge Over Colorado River Proposed

A bill was recently introduced in the Arizona Legislature appropriating $150,000 for the construction of a bridge over the Colorado River near Pierce Ferry. This bridge would connect the Arrowhead Highway of Utah with highways in northern Arizona.

Road Work in Montana

Federal aid projects totaling 935 mi. were surveyed in Montana during 1920 and detailed plans have been completed on 849 mi. Contracts have been awarded for 72 out of 92 projects in 33 counties, at a total estimated cost of $5,593,784. Plans have been completed on 20 additional projects, involving 124 mi. at an estimated cost of $1,524,727. It is expected that during 1921 additional contracts for 175 mi. of road, at a total cost of $2,250,000, will be awarded.

New Jersey Plans Road Between Hudson River Tunnel and Camden Bridge

The New Jersey State Highway Department is considering the construction of a highway from the Hudson River vehicular tunnel at Jersey City to the Delaware River Bridge at Camden, when these two improvements are completed. A committee to confer with the New Jersey Tunnel and Bridge Commission was named as follows: Thomas J. Collins, of Elizabeth; George Paddock, of Newark; John Ferris, of Jersey City; A. S. Doughty, of Burlington.

Two Spans of Bridge Collapse at Dayton, Ohio

On Jan. 21, two spans of the bridge over the Miami River at Third St., Dayton, O., failed, precipitating two automobiles and three persons into the river, but with no loss of life. This bridge is constructed of reinforced concrete and was built in 1906. It consists of seven spans of 80 to 110 ft. and has a total length of 710 ft., with a width of 62 ft. and a height of 30 ft.

An investigation being carried on by the Dayton Engineering Department has disclosed that the failure was caused by the sinking of the pier between the two arches which collapsed.

Engineers of Baltimore City to Meet Weekly

Weekly meetings of the heads of the engineering departments of Baltimore, Md., will be held and round table discussions of the city's affairs will take place. Weekly reports of the work of each department will be submitted and it is hoped that the efficiency of the several departments will be increased.

Road Work in Butte County, California

Of the $1,800,000 road bond issue passed by Butte County, California, only $40,000 has been spent for preliminary grading work, according to Harvey Hume, County Highway Engineer. However, it is planned to start road construction on a large scale in 1921 with the bond issue fund. During the last five months of 1920, about $74,000 was expended from the county road fund for maintenance work.

Road Work in National Forests

Forest Service is Constructing Roads in Columbia and Stanislaus National Forests

The necessary clearing and burning of brush and logs on the Little White Salmon Road, which is partly within the Columbia National Forest, Washington, has been completed, according to T. W. Norcross, Chief Engineer of the Forest Service, U. S. Department of Agriculture. This road was constructed in the latter part of 1919 by the Forest Service and Skamania County at a cost of approximately $4,522, the work being done under the supervision of the U. S. Bureau of Public Roads. The road extends up Little White Salmon Valley from State Road No. 8, connecting with a road in the Columbia National Forest built in 1915 and 1916. The road is 2.6 mi. long, 16 ft. wide, with a maximum grade of 5% and a minimum radius of curvature of 100 ft.

An agreement has been reached between the Forest Service and Calaveras County, California, providing for the making of surveys and plans for a road 16 mi. long and extending between Murphys and Calaveras Big Trees. Nine miles of this road lie within the Stanislaus National Forest. The agreement provides that the surveyed road shall be designed for a general grade of 6%, a maximum grade of 8% and a general minimum radius of curvature of not less than 50 ft. The estimated cost of the survey is $5,200, which will be shared jointly by the county and the Forest Service.

The Murphy-Big Trees Road is a section of the Carson-Big Trees Road, which forms a short connection on easy grades and excellent alignment between San Joaquin Valley, California, and Carson Valley, Nevada. The road will make accessible the Calaveras Big Trees and many other points of interest.

MEETINGS

Calendar of Coming Meetings

Feb. 9-12.—American Road Builders' Association. —Eighteenth Annual Convention, Eleventh American Good Roads Congress and Twelfth Good Roads Show under the auspices of the A. R. B. A., The Coliseum, Chicago, Ill. Secretary, E. L. Powers, 11 Waverly Place, New York, N. Y.

Feb. 11-12.—Engineering Society of Wisconsin.—Annual meeting, Madison, Wis. Secretary, Leonard S. Smith, Madison, Wis.

Feb. 14-16.—American Concrete Institute.—Annual meeting, Auditorium Hotel, Chicago, Ill. Secretary, Harvey Whipple, Detroit, Mich.

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11.—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

Memphis Engineers' Club

At the annual meeting and dinner of the Memphis Engineers' Club held in Memphis, Tenn., on Jan. 10, the following officers were elected: President, R. W. Gay; Vice President, J. H. Haylow; Secretary and Treasurer, A. S. Fry.

Engineers' Society of St. Paul

The annual meeting of the Engineers' Society of St. Paul, Minn., was held on Jan. 10 and the following officers elected for the ensuing year: President, J. H. Mullen; Vice President, W. W. Walker; Secretary, A. A. Sommerfield; Treasurer, W. N. Carey.

Iowa Engineering Society

The annual meeting of the Iowa Engineering Society was held in Des Moines on Jan. 18, 19 and 20, with about 400 in attendance. Officers elected are as follows: President, J. H. Dunlap; Vice President, A. Le Van; Director, J. D. Wardle. H. W. Thompson was chosen chairman of the highway section, L. M. Martin, vice chairman and C. W. Eby, secretary.

Texas Roadbuilders' Association

The second annual convention of the Texas Roadbuilders' Association was held at Austin on Jan. 19, 20 and 21, with an attendance of 127. Officers were elected as follows: President, L. G. Mathews, County Judge, Coleman County; Vice Presidents: Julian Montgomery, City Engineer, Wichita Falls, W. O. Washington, Engineer, Cameron County, D. E. Manigalt, Engineer, Division No. 5, El Paso, W. J. Kelly, Engineer, Trinity County; Directors: Fred Rightor, President, Southwest Bitulithic Co., H. L. Small, County Judge, Tarrant County, E. L. Dennis, Jr., Sales Manager, Texas Trap Rock Co., J. C. Nagle, Dean, Texas A. & M. College.

University of Michigan to Hold Highway Conference

A Mid-western Conference on Highway and Highway Transport Education will be held at the University of Michigan, on Feb. 23, under the auspices of the Permanent Committee on Highway and Highway Transport Education, the University of Michigan and the Michigan State Highway Department.

P. P. Claxton, U. S. Commissioner of Education, will preside at the morning and afternoon sessions. The following papers and addresses will be given in the morning: "The Highway and Social and Economic Welfare," by P. P. Claxton; "The Educational Activities of the Permanent Committee on Highway and Highway Transport," by C. J. Tilden, Director of the Committee; "The Economics of Highway Transport," by Roy D. Chapin, Vice President, National Automobile Chamber of Commerce; Highway and Highway Transport Education in Secondary Schools," by Geo. C. Diehl, Chairman, Good Roads Board, American Automobile Association; "Safety First Education in Secondary Schools," by Harriet E. Beard, Supervisor of Safety Education, Detroit, Mich. In the afternoon Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads, will speak on "The Measure of Highway Accomplishment"; Col. Mason M. Patrick, Corps of Engineers, on "The Army's Highway Transport Problem;" Henry E. Riggs, Professor of Civil Engineering, University of Michigan, on "The Interrelationship of Waterway, Railway and Highway Transport;" C. J. Bennett, State Highway Commissioner of Connecticut, on "Snow Removal from Transport Routes;" Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport, University of Michigan, on "'The Economic Value of Highway Transport Surveys."

Mortimer E. Cooley, President of the Society for the Promotion of Engineering Education, will preside at the dinner to be held at 6 p. m. in the banquet hall of Michigan Union. After-dinner addresses include, "Highway Transport and the Industry," by Tom Snyder, Secretary, Indiana Highway Transport and Terminal Association; "Interrelationship Between Highway Transport and Back to the Farm Movement," by A. R. Kroh, Development Department, Goodyear Tire & Rubber Co.

Marion L. Burton, President, University of Michigan, will preside at the evening session. William C. Redfield, former U. S. Secretary of Commerce, will speak on the "Trinity of Transportation." A highway transport motion picture, "What's Your Hurry?" will conclude the program.

The Cambria County, Pennsylvania, County Supervisors and Good Roads Association held its annual meeting at Cresson, Pa., on Jan. 14 and 15.

The road supervisors of Washington County, Pennsylvania, held their annual convention on Jan. 18 at Washington, Pa. Several officials of the Pennsylvania State Highway Department and prominent local citizens of the county spoke at the meeting.

PERSONAL MENTION

W. J. Kelly has resigned as engineer of Walker County, Texas.

R. D. Morgan has resigned as county engineer of Bell County, Texas.

Alfred S. Tee, for 14 years city engineer of Astoria, Ore., has resigned.

J. H. Treadway has been appointed county engineer of Bell County, Texas.

F. B. Hayes has been appointed city engineer of Pendleton, Ont., Canada.

K. C. Cade has resigned as county engineer of Dickerson County, Texas.

W. D. Johnson was recently appointed engineer of Black Hawk County, Iowa.

M. E. Hiet has been appointed road engineer of Nowata County, Oklahoma.

Louis S. Levin has been appointed road engineer of Chippewa County, Michigan.

Dudley Atkins, Jr., has been appointed county engineer of Osage County, Kansas.

John P. Leo has been appointed commissioner of street cleaning of New York City.

Charles A. Tutewiler has resigned as a member of the Florida State Road Department.

Jay H. Dobbin has been appointed a member of the Oregon State Highway Commission.

A. R. Taylor, State Highway Commissioner of Ohio, has been removed by the new governor.

W. A. Hendry has been appointed chief engineer of the Nova Scotia Provincial Highways Board.

P. L. Culley, formerly an asphalt salesman for the Magnolia Petroleum Co., is now connected with the Beaver Board Co.

A. H. Dimock, City Engineer of Se attle, Wash., has been reappointed for five years and his salary increased to $7,500.

Joel A. Thayer, formerly Superintendent of Streets of Taunton, Mass., is now New England manager of the Acme Road Machinery Co.

D. P. Babcock, formerly Assistant Engineer with the New York State Highway Department, is now assistant engineer with the Bronx Parkway Commission, New York City.

OBITUARY

Samuel Foust, City Engineer of Connellsville, Pa., died Jan. 5 in that city, at the age of 75.

J. E. Kennedy, formerly City Engineer of Vancouver, B. C., Canada, recently died at Owen Sound, Ont.

Bradford D. Pierce, for many years Director of Public Works of Bridgeport, Conn., died on Jan. 12 in that city at the age of 79.

J. C. Rock, General Agent of the United States Asphalt Refining Co., died at his home in New York City at the age of 75 years. Mr. Rock was one of the pioneers of the asphalt paving industry in this country. At the age of 15 he entered service in the Civil War, after which he was employed in several Government departments, leaving the Bureau of Engineering of the District of Columbia in 1889 to become secretary of the Barber Asphalt Paving Co.

GOOD ROADS

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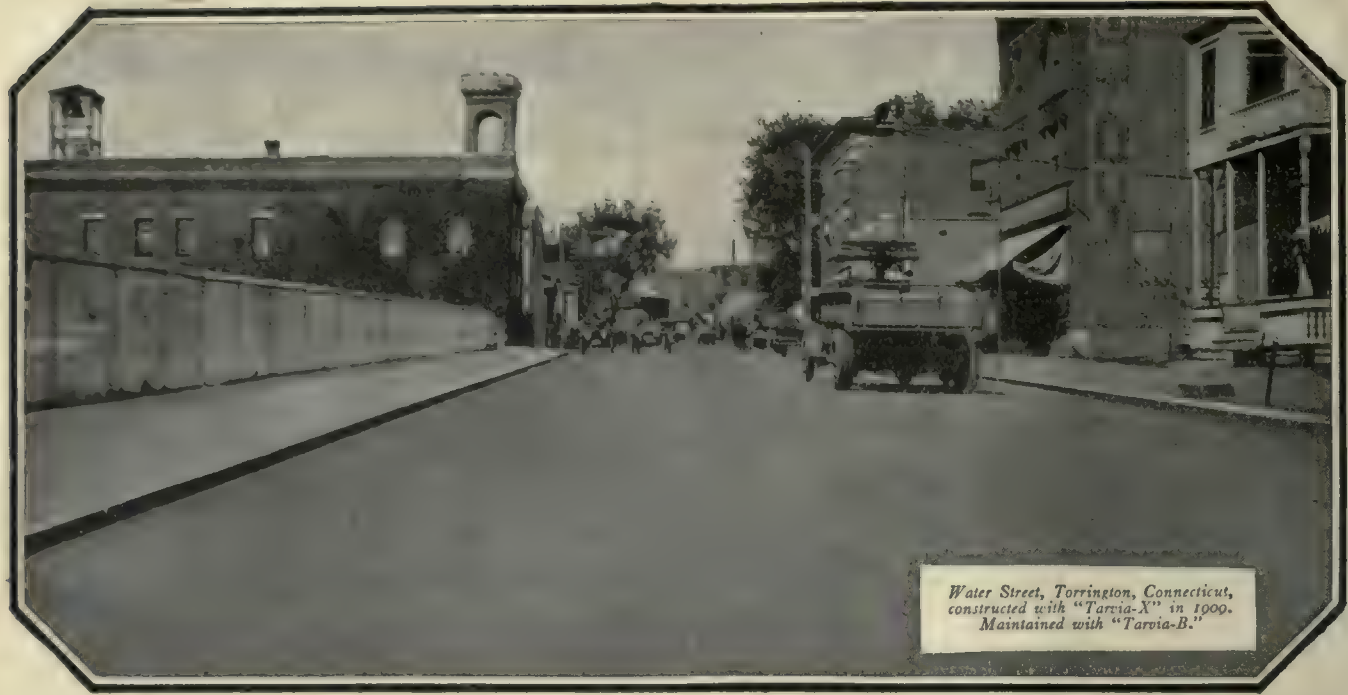

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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JAMESTOWN, N. Y., FEBRUARY 16, 1921

Number 7

The Eighteenth Annual Convention of the American Road Builders' Association

The Eighteenth Annual Convention of the American Road Builders' Association and the Twelfth National Good Roads Show under the association's auspices were held at the Coliseum, Chicago, Ill., on Wednesday, Thursday, Friday and Saturday of last week—Feb. 9 to 12, inclusive.

In point of numbers in attendance at the technical sessions the convention exceeded all previous ones, while the number of exhibits in the show and the variety of equipment and materials shown were greater than those of any other exhibition.

A chronological report of the sessions of the convention is given in the following pages. Papers and addresses are not included, as it is hoped to present the papers in their entirety in this and future issues as space permits. An account of the show will be printed in a later issue.

Wednesday, February 9

The first session was called to order on Wednesday morning by the president of the association, Michael J. Faherty, President of the Chicago Board of Local Improvements. After the invocation, President Faherty very briefly welcomed the convention to Chicago. He referred to the highway work done and planned in Illinois and in Chicago, pointing out that in the city alone 1,260 mi. of streets had been built in the past five years. He thanked the officers of the association for their cooperation in arranging for the convention and then introduced as the presiding officer of the morning session, Col. H. L. Bowlby, Chief of the War Materials Division of the U. S. Bureau of Public Roads.

In introducing the first speaker, Col. Bowlby said that it is no longer necessary to have speakers urge the necessity of good roads, but that the present problem is how to spend the money available. He then introduced Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads, whose paper was entitled, "Our National Road Problems." His message to road builders was one of optimism as to the future of road building. He pointed out that there is an unprecedented amount of money available for road work and that it is time to spend it. Among the points he emphasized were the benefits accruing from study and research and from long tenure of office by highway engineers and officials. He also spoke of the work accomplished by the Government in the building of roads and outlined briefly some of the policies of the Bureau of Public Roads.

Prof. J. C. Tilden, Director of the Highway and Highway Transport Committee, U. S. Bureau of Education, was the next speaker, his topic being "Relation of the Highway and Motor Transport Movement to Education."

The last address of the morning session was made by Dr. S. M. Johnson, of Roanoke, Va., General Director of the Lee Highway Association, who spoke on "The Local and National Importance of the Lee Highway."

During the session, the chairman announced the appointment of the Committee on Resolutions, as follows: C. M. Upham, Chief Engineer, Delaware State Highway Department, Chairman; S. E. Platt; H. G. Shirley, Secretary, Federal Highway Council; J. R. Draney, President, Bitoslag Paving Co., New York, N. Y.; C. R. Eddy; W. P. Blair, Vice President, National Paving Brick Manufacturers' Association; J. A. Duchastel, City Manager of Outremont, P. Q.; Geo. W. Tillson, La Grange, Ill.; Dr. S. M. Johnson, General Director, Lee Highway Association.

M. O. Eldridge, of the American Automobile Association, presided at the afternoon session in the place of Geo. C. Diehl, County Engineer of Erie County, New York, who was scheduled to preside, but who was unable to be present. In announcing the first speaker he called attention to the growth of motor traffic and the necessity of building roads to take care of it. He said that we had come to a point where we must build roads and predicted that within the next few years this country would have the finest system of roads of any country in the world.

The first paper of the afternoon was presented by J. W. Brooks, Manager of the Educational Bureau of the Federal Highway Council, its title being, "The Highway's Part in the Development of Efficient Transportation." The topic was further discussed by D. C. Fenner, Chairman of the Motor Vehicle Conference Committee, New York, N. Y.

The second and last paper of the afternoon was "Road Building in Alaska," by Col. James G. Steese, C. E., U. S. Army, President of the Alaska Road Commission. Besides reviewing the road work already accomplished in that territory and outlining the plans for the future, Col. Steese gave a very interesting description of Alaska and its development, especially along commercial lines.

GROUP OF DELEGATES AND GUESTS AT THE EIGHTEENTH ANNUAL CONVENTION OF

On Wednesday evening there was a public mass meeting at Medinah Temple, at which there was a large attendance of delegates and guests. The speaking was preceded and interspersed by selections by the Great Lakes Naval Training Station Band and the Strand Quartette and was followed by a short exhibition of moving pictures depicting the development of highway transportation and the construction of modern roads.

The meeting was called to order by the secretary of the American Road Builders' Association, E. L. Powers, Editor of GOOD ROADS. After thanking the officers of the association and the local committees for their cooperation in carrying out the plans for the convention and show, he introduced President Faherty, as the first speaker and the chairman of the meeting.

President Faherty expressed his appreciation of the efforts of the association's officers and the committees and welcomed the convention to Chicago. He also spoke at some length of the street work in the city and deplored the inability of highway engineers to get together on a specification for a good road. In commenting upon the difficulties of carrying on highway work under the conditions that have obtained for the past few years, he referred to the high cost of road and street work and held that the high prices of materials, and not the contractors, were largely responsible. Using cement as an illustration, he stated that cement could be manufactured for 57 ct. a barrel, while Chicago contractors had been obliged to pay as much as $4. He said he believed that the laws of Illinois would permit the condemnation of cement mills and suggested that "the best cement plant" in the state be condemned and operated for the benefit of contractors in Chicago and elsewhere in the state who are building concrete roads and pavements.

Mayor William Hale Thompson of Chicago was the second speaker of the evening. He welcomed the convention to the city and briefly touched upon some of the paving problems confronting the city officials. He said that he believed that road work would start in the city and the state early in the spring and that we had before us the greatest year of good road building that we had ever looked forward to. In view of this, he believed, the deliberations of the convention would be of more importance than ever before. The rail lines, Mayor Thompson said, have been taxed far beyond their capacity, and the solution of the resulting problem lies in good roads and good trucks.

After Mayor Thompson's address, two communications to the convention were read by Royal N. Allen, Secretary of the Chicago Executive Committee. The first, from President-Elect Warren G. Harding to President Faherty, was as follows:

"I have received, through Mayor Thompson, of Chicago, your request for an expression regarding the work of your association and comply with pleasure because of my deep concern for more and better roads. I regret being unable to attend your exposition.

"Our civilization depends on communication and transportation, and as it becomes increasingly complex, that dependence increases. Every great community is held together by its means of transportation and so vast a country as ours is the more in need of ample facilities. Our country roads we have not kept pace with. The development of other transportation—railroads, waterways, our new merchant marine—cannot be of fullest utility unless good roads supplement them. The country road bears the same relation to these that the capillary circulation does to the system of veins and arteries in the human organism.

IERICAN ROAD BUILDERS' ASSOCIATION AT THE COLISEUM, CHICAGO, ILL., FEB. 9-12, 1921

"In recent years there has been nation-wide realization of the road problem. We need to devise and adapt means, financial and engineering, to solve it. I believe we shall progress greatly, in the years of peace and prosperity which I am confident lie ahead of us, toward this solution, and such organizations as your own will contribute much to that end.

"With all good wishes that you may have a successful and useful exposition, I am,

"Yours most sincerely,"

(Signed) WARREN G. HARDING.

The second communication read by Mr. Allen was from Governor Len Small, of Illinois, who was scheduled to speak, but was unable to be present. Governor Small's telegram follows:

"Daily sessions of the Legislature at this time render it imperative for me to remain in Springfield. I regret exceedingly my inability to come to Chicago and attend the meeting at Medinah Temple tonight. I am in thorough sympathy with your movement, as shown in my inaugural address. I shall do all in my power as governor of Illinois to carry forward as rapidly as possible the work of building good roads in this state. Good roads are vitally needed and mean much to the people of this state and of this country. I hope your convention is a wonderful success."

The last address of the evening was by P. T. Colgrove, President of the Michigan Good Roads Association. Mr. Colgrove emphasized the advantages of good roads and described the work done to secure road improvement in his own state. He also spoke of the early efforts to secure federal aid for road work and of the lack of success that attended those efforts.

Thursday, February 10

C. M. Upham, Chief Engineer of the Delaware State Highway Department, presided at the third session of the convention, which was devoted to the consideration of subgrades and drainage.

The first paper, "Subgrades," was presented by H. G. Shirley, Secretary of the Federal Highway Council. The subject was further discussed by Clifford Older, Chief Highway Engineer of Illinois, and by a number of delegates speaking from the floor.

F. H. Eno, Professor of Engineering at the Ohio

State University, presented a paper on the "Importance of Drainage in Road Construction," illustrating it by demonstrations of the behavior of clay under various moisture conditions. A written discussion prepared by H. S. Mattimore, Testing Engineer of the Pennsylvania State Highway Department, was read.

The principal speaker at the afternoon session was State Senator James H. MacDonald, of Connecticut, the former state highway commissioner of that state. His subject, "Types of Pavements," was treated from a very broad standpoint, rather than one of construction details. He especially emphasized the importance of good roads and of selecting proper pavement types for use under various conditions.

Senator MacDonald's paper was discussed by C. M. Upham, who confined his remarks to the cement concrete pavement, with especial reference to smoothness, the quality in which, he holds, the average road user is most interested. He said that the smoothness of a cement concrete pavement depended very largely upon the forms used and urged the making of heavier, more rigid forms.

Friday, February 11

The paper occupying the attention of the convention at the fifth session, on Friday forenoon, was "The Concrete Road System of Wayne County," which was presented by Edward N. Hines, Chairman of the Board of County Commissioners of Wayne County, Michigan. Mr. Hines gave a detailed description of his county's road system and reviewed the history of the work. He also outlined briefly the plans of the commission for future work.

Following Commissioner Hines' paper, there was some general discussion and a resolution was proposed calling for an investigation of the high cost of road building. The resolution was referred to the Committee on Resolutions.

Frank F. Rogers, State Highway Commissioner of Michigan, presided.

At the afternoon session D. C. Fenner, Chairman of the Motor Vehicle Conference Committee, presided in place of Howard F. Beebe, who was not present. The paper of the afternoon, "Highway Finance," was presented by H. C. Sylvester, Vice President of the National City Co., New York, N. Y. The paper was discussed by S. E. Bradt, Superintendent of Highways, Illinois Department of Public Works and Buildings, Prof. J. G. McKay, Chairman Fenner, and M. O. Eldridge, of the American Automobile Association. The discussion centered largely upon the matter of bond issues, but several of the speakers also touched upon the distribution of the cost of road improvement and the limitation of truck weights.

Saturday, February 12

In accordance with the program, only one paper, "Relation Between Engineers and Contractors," was presented at the morning session on Saturday. The paper was presented by W. A. Rogers, Ex-President of the Associated General Contractors, who also presided at the meeting. The formal discussion of the paper was by R. G. Collins, of the Keystone Construction Co., and A. R. Hirst, State Highway Engineer, of Wisconsin. A written discussion by D. A. Garber, President of the Northeastern Construction Co., who was not present, was read by title. Following these formal discussions there was considerable general discussion by C. M. Upham, Richard Hopkins, and others. One of the chief points made by Mr. Rogers was that the state should not buy materials, as the contractors could buy as cheaply as the state and could control deliveries even better. Mr. Hirst's discussion was a very strong plea for better salaries and longer tenure of office for highway engineers and officials.

Practically the entire session on Saturday afternoon was taken up by the report of the Committee on Resolutions. The report as finally adopted follows:

Resolutions

WHEREAS, the country, states and municipalities are now considering the improvement of their roads, streets and other public highways; and

WHEREAS, such road and street improvements are urgently needed by the public and are for the benefit of the general public; and

WHEREAS, many such improvments are being abandoned or at least indefinitely postponed because the cost is considered prohibitive by the officials in charge of such work; and

WHEREAS, one of the large elements of such cost is the freight charges on the materials used in paving and road construction; and

WHEREAS, such freight charges have been materially advanced by the carriers during federal control, which advances were specific amounts per 100 pounds or per ton, and were greatly in excess of the percentage advances imposed on other classes of freight; and the rates so advanced were in August, 1920, again advanced 35 to 40%; and

WHEREAS, there is at the present time an urgent necessity for providing employment to thousands of unemployed men;

NOW, THEREFORE, BE IT RESOLVED by the Eleventh Good Roads Congress of the American Road Builders' Association, in meeting assembled at Chicago, Illinois, this 12th day of February, 1921:

THAT, we request and urge the Interstate Commerce Commission, the Central Freight Association, Western Trunk Line Committee, and other similar associations and committees of the carriers, to immediately reduce the rates 25% on sand, gravel, crushed stone, brick, cement, and asphalt when consigned to officials of the United States, any of the states, counties, municipalities, or to contractors for use in the construction or paving of public roads, streets or other public highways.

BE IT FURTHER RESOLVED THAT copies of this resolution be sent to the Interstate Commerce Commission, Central Freight Association, Western Trunk Line Committee

(Continued on page 104)

Our National Highway Problems*

By THOS. H. MacDONALD†

Prefatory to the discussion of the highway problems which are national in character it should be understood that present conditions are such that a large program of highway improvement should go forward, now and without delay. Funds are available; the state and federal highway departments are ready to award highway contracts for large mileages. It is estimated that from all sources approximately $622,000,000 is available for highway work.

Admittedly there are many and grave problems in our developing highway program which must be met. Still, with more than 3,500,000 unemployed and with the railroads eagerly offering transportation for the necessary material, there is every justification for vigorous action to inaugurate a large public works program, with confidence that the problems will be adequately solved as, and when they arise, and should not be made an excuse for delay now.

A former editor of one of our well known Mississippi Valley farm papers liked to go among the people, of whom many hundreds felt in him a personal friend and for him a great affection. He held the confidence of his public because he did not fail to preserve his perspective, and he frankly let the truth be known, even when it brought into question the full wisdom of those who, through their own choosing, had become teachers or publicists. His characterization oftentimes ran thus: "Them that can, does; them that can't teaches."

Nationally we are in a transition and reconstruction period from many causes; and, as is to be expected, the highway question is one of those acutely affected by these changing conditions. There has been for no length of time stability of the requirements with which the highway builder is contending today to permit the teachers to instruct accurately from the experience of the past. The man who must do, and who will be held responsible for the results, is confused by the contradictory solutions which he and others of his class have thrust upon them. As usual, we are in a great hurry. We cannot wait for the teacher to develop his theories, and we insist that the doer engage upon a vast program of construction, entailing expenditures far beyond our extreme conceptions of only a few years ago. We have been turning the clock ahead at a whirling rate. Fortunately, there has been a powerful brake upon our ability to expend funds, through the very physical handicaps imposed by the task itself. If labor, if rail transportation, if materials are not to be had, it is impossible actually to pay money out of the public treasuries for these purposes.

The highway engineer and the highway administrator are not guaranteed a safe passage through smooth waters, after avoiding the Scylla of a single problem on the one side and the Charybdis of another on the other. In the development of the highway program in this nation there is involved not one, but a large number of major problems, so extensive that they will constantly demand very large expenditures and the allocation of a great amount of labor and materials to this purpose by the public as a whole, in return for highway service, rendered primarily to the individual, but collectively, to itself. So let us not hope or expect ever to find the final solution for all highway problems, for they will continue on to the end of the chapter, yet they will not be the same; or, at least, if fundamentally the same, will appear in different guises and with many modifications.

The highway problems which are of an engineering nature are capable of solution if adequately attacked; those which are economic are also capable of solution, but in principle rather than in detail. The application will need always to be localized. Of these two classes—certainly not minimizing either—the most immediately serious are economic rather than engineering, and of the economic problems the determination of the amount and character of service which is to be required from the highways is the most important. Only in a few of the more advanced states does an adequate conception exist as to the traffic—present and prospective—which must be carried over the highways. The character and amount of traffic which the highways must carry can, through painstaking studies, be reasonably determined. Such a study should precede the settling of the second problem which is of immediate importance, that is, the mileage rate of improvement. For example, let it be determined within any state that only the high-class, heavy-duty pavements will be constructed, and automatically the rate of progress has been fixed. There are now two distinct theories of improvement: First, the one which seeks to extend a comparatively limited mileage of high-class roads annually as fast as the funds and available materials and labor will permit; second, the one which seeks to bring a comparatively large mileage of highways to a usable condition in the shortest time possible. This second theory automatically determines that a large percentage of such mileage will be of the lower cost roads, with their well known traffic limitations.

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*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Chief, Bureau of Public Roads, U. S. Department of Agriculture.

The liberty has been taken with the title of this paper to interpret it as meaning a diagnosis rather than a prescription, but it may be pointed out here as indicating the need for the early establishment of sound economic principles in the administration of our highway work, that the first theory is being applied in some states where assuredly a large mileage of development roads of the lower cost types would serve the traffic under present conditions and for a long time in the future, and the second theory is being applied in some states where such type of roads have already become a liability rather than an asset. The Bureau of Public Roads has, within a few days, been requested to revise downward its minimum design and specification requirements for heavy traffic main roads in one of the most populous states where the truck traffic is growing by leaps and bounds. At the same time, we are approving plans for roadways in some of the thinly populated sections where, although in our judgment the investment is sound, nevertheless at the rate of improvement possible within the funds that are and can be made available, the mileage of improved highways will not be adequate within a reasonable period to take care of the development of traffic.

Recently there has appeared a most severe criticism of the engineering and administration of a state highway department which has provided good highway service on a selected system of roads into practically all parts of a large state with a minimum expenditure of time and funds. The balance sheet for this system of roads is neglected. The ratio of returns to investment is forgotten because a very moderate percentage of the surfacing has failed and is now in need of reconstruction. Is it any wonder that the necessity for an understanding of the economic problems is given a super position?

This discussion relates more particularly to the economic problems of state and federal highway administration, which, in a major sense, has been confined to a limited percentage of roads. It is estimated that about 8% of our total road mileage is covered by the state systems on which the state and federal funds are concentrated. The other 92% of the roads carry much traffic, and the same general discussion applies to each class, but the necessity for a decision as to the expenditures of funds for the extension of a comparatively large mileage, or their concentration on a short mileage of high type roads, relates chiefly to this small percentage of total highway mileage. The total road mileage of the United States would encircle the globe nearly 100 times. We are now largely concentrating the federal and state engineering and administration upon only one-twelfth of this total mileage, and there is a demand for an even smaller concentration of these funds, particularly those which have been appropriated by the Federal Government.

Just now we have literally a pocketful of money. Funds have been made available in large amounts by the Federal Government, the states, the counties and even smaller districts, which have accumulated because of non-expenditure; but we should not hypnotize ourselves into the belief that this condition will continue to exist, unless the balance sheets show profits on these expenditures in the way of highway service to all of the people by whom these funds are contributed. The earning capacity of our roads must be demonstrated. There are plenty of communities, even as large as a whole state, which have already bonded themselves to their legal limit to provide the funds that are available now. Admittedly these limitations are arbitrary rather than fixed by economic considerations. With the task of highway improvement only begun, it is apparent that either new sources of revenue must be found, or these limitations must be changed. I have faith that these limitations can and will be raised to permit of the continuation of a large program of improvement, but such a continuation will come to be more and more dependent upon the balance sheet which we are able to show of profits derived.

The fact that there is not complete concurrence in the concentration of the necessary funds for the building of the better class of highways is well demonstrated by some of the recent measures which have been put before state legislatures, which would require the spreadng of the highway funds over large mileages of the lower cost roads and the traffic absolutely demands them. Herein lies one of the chief virtues of the Federal Aid Road Act, and particularly in the provision of the act which requires that the federal funds must be allocated to projects of substantial construction. Serious problems are confronting the lawmakers of both the Federal Government and the states to provide the ways and means for securing sufficient revenues to meet the expenditures called for in the public budgets, even though these be trimmed and cut until they place insurmountable limitations upon the development of many of the highly advisable public activites. It must be clearly apparent to the fair minded that the unanimous support which has been given the Federal Aid Road Act by those in administrative control of the state highway departments has resulted from the helpful and stabilizing influence which the principles of this act have brought to bear upon the development of highway legislation and highway policies. We are passing through a period in which the development of these policies is accelerated. But is not the whole history of the highway movement in this country a succession of steps from one phase to another? The steps which we take now are of greater consequence because it is well demonstrated that the use of the highways has increased from 500 to 1000% in a period of perhaps five years. There are rural highways contiguous to centers of population of less than one-tenth of that of our largest cities, which today carry as high as 12,000 to 15,000 vehicles during the days of maximum traffic. Assuming that this statement of facts demonstrates the rapidly changing economic conditions which must be encountered, does this not present the problem of insuring stability in the personnel of the highway administrative bodies who are responsible for the development of economically sound policies?

Next to the determination of the economic problems, perhaps none is of greater import than the stabilizing of the administration of highway affairs. It has been pointed out by competent observers that one of the reasons that the highways in England are carrying extremely heavy concentrations of traffic without serious deterioration, is the continuation in office for long periods of competent engineers who have thus been able, through intimate and continuous observation, to apply for the benefit of the locality the knowledge gained at the expense of the community itself. Let is stand out as a bold, unchangeable fact that the public pays for the education of its public servants. Someone has remarked that a change of employees is likely to prove only a change of faults, and there is such a demand now for highway engineers that it must be understood that every man whose education and experience have been along this line grows more valuable to the community with the years of his experience in dealing with the particular problems of the community.

The administration of the Federal Aid Road Act has pointed out certain other problems of a major character. One of these which should be remedied at once is the failure of a large group of states to provide state revenues, as such, to meet the federal funds. About one-third of the states are in this category. Some of these have been limited, through constitutional inhibitions upon their power to raise revenues for internal improvements. It is apparent that in those states which depend upon the counties or districts to supply funds to meet the federal aid appropriations without assistance from the state, the local interests will demand consideration. This influence has not yet seriously affected the logical development of the most important state highways only because the roads in the different communities which are of the largest importance from the state viewpoint have also been of major importance to their respective localities. This being true, great progress has been made, even in the states having no state revenues, upon the development of state and interstate systems. But to be of state and nationwide service, the improvement of the system must go forward in the communities which can ill afford the luxury of main line highways no matter how badly they are needed. The immediately local use of the highways and the ability of communities to pay bear a reasonably constant ratio to each other, diminishing or increasing together. But a study of the states shows that interposed between the wealthier communities are those which, although devoting a greater proportion of their wealth to highway improvement, cannot in fairness be required to construct main line highways to complete the state and interstate systems. Only from state and federal funds can the development of such systems be assured. This same general principle holds true for the United States as a whole, and it appears that favorable consideration will be given to the recommendations of the Secretary of Agriculture and the Bureau of Public Roads that the present equal cooperative funds required from those states having large areas of public lands which are non-productive of revenues, but are highly exhaustive of the funds since the highways must be continued across these great expanses, will be decreased in proportion to the percentage of the public lands within their borders.

And after roads, of whatever type, are constructed, comes the major problem of maintenance. Rather let it be said that if the task today is to provide highway service, we cannot afford to wait for the construction of new and modern types of highways. The maintenance should be carried forward now on roads improved and unimproved. The returns will more than compensate the cost. If there is one problem which the road builders of the United States as a whole must learn it is that of highway maintenance. The continuity and long radius of operation of the motor vehicle require a development of maintenance organizations and maintenance expenditures not heretofore required; but in the same fact lies, because of the service rendered, the justification for the expense involved. We cannot neglect the simple methods of maintenance which have demonstrated their utility. The harrow, the road drag, the blade grader, have a high degree of utility in combination with the motor truck and gas tractor. One state engineer remarked that the widespread use of these simple maintenance tools in his state saved his whole program of higher cost construction, because of the better highway service provided over a large mileage.

As has been pointed out, we have concentrated state and federal highway organizations and funds upon a small mileage of roads, but because service is demanded from all of the roads we cannot neglect the upbuilding of the county organizations. Smaller than county organizations should be done away with as soon as possible, and the administrative conduct of the work in the counties concentrated under competent highway engineers. There should be a correlation between the work of these county engineers and the state highway department. Much of the more involved technical work such as the design of bridges the planning of standards, designs, development of

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Relation of the Highway and Motor Transport Movement to Education*

By PROF. C. J. TILDEN†

One of the chief functions of schools is to fit young men and young women for the business of life. In the lower grades there are certain fundamentals universally recognized as necessary, so that there cannot be much variety in the topics covered in primary and grammar schools. In the four years of the high school, however, there is a wider choice. The student may take a business course, or a classical course or attend a technical high school, and often one or more options are permitted in the later years of each of these courses, to accord to a certain extent at least with the wishes of the pupil or his expectations with regard to a life work. In college there is a much greater choice. In the technical schools, for example, there are many sub-divisions and special electives, planned to fit for different phases of professional work. Generally the individual courses of study are pretty definitely worked out, smoothed and polished and coordinated through several years of teaching and study, and carefully fitted into the mosaic of the four-year program.

But times change. Topics which were of utmost importance a few years ago, and in which college courses have been established, may cease to have the relative importance in changed commercial and industrial conditions. A case in point is the theory and science of railroad location, a vitally important subject a generation or so ago. Today the problems of highway location, construction and maintenance are far greater than in railroad work, and yet most of the older colleges devote much more time to railroad courses than to those in highways. Just what is the situation today as regards highways? And how are the highways, as more or less organized system of transportation, being used by the citizens who build and support them? It may be well to review briefly some of these questions and then see in what way the colleges can help in fitting future citizens to take their part in this important development.

It has been said that the chief problem before the country today is that of distribution. The fundamental problems of production have been largely solved. While there are many details that are still being worked out, and certain new problems are constantly arising, the basic principles are pretty well understood. The same may be said of transportation. Railway organization has been thorough, operation systematized, and up to the time that the Government took over operation during the war our railway system as a whole was pretty generally satisfactory. Water transportation is limited, but it has always formed an important part of the transportation system of the country, where it could be used economically.

Highways have always been a most vital part of our general transportation scheme, reaching as they do every community and each individual farm and bringing them into contact with the main centers of distribution whether railway or waterway. This universal need for roads has led to a basis of highway building entirely different from that of railway building. The highways are free paths over which anyone may travel; they are built and maintained by public funds (except in the very rare instances of toll roads), and an important body of public law has developed, regulating their construction and use.

During the war our highways were enormously overloaded. Not only was railway transportation necessarily limited, but the greater convenience and speed, in many instances, of the motor truck brought that phase of transportation very much to the foreground. It was soon discovered, however, that certain roads, built on what were supposedly the soundest principles of highway construction would not stand up under the rapidly increasing loads of heavy trucks. Many miles of road were destroyed. It was evident that new principles of highway construction must be developed. Engineers are still seeking the best way of meeting this new problem, and many are at work on research along those lines. Foremost of these research agencies is the United States Bureau of Public Roads which has been, and still is, doing unusually fine work in the scientific investigation of highway materials, methods of construction, and other problems relating to the road.

Since the war there has been a remarkable increase in highway building, reconstruction and improvement. The generous appropriation of federal money apportioned to the states under the Federal Aid Act has stimulated this activity to a large extent. In the current year, 1921, there is available for highway construction and maintenance several times as much money as has ever been spent for that purpose in a single year before. While the figures are not as yet exact, a careful investigation by the statisticians of the Bureau of Public Roads within the last two or three weeks places this total at $697,-

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*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Director, Highway and Highway Transport Committee, U. S. Bureau of Education.

000,000, an average of about $2,000,000 a day available for expenditure in building, maintaining and improving roads. This, of course, is for the country as a whole and includes state and county appropriations, as well as those of the Federal Government. It does not, however, include entire bond issues, but only such portions of these as are available for the current calendar year. The total stated above, therefore, nearly $700,000,000, is the amount actually on hand ready for spending in 1921. It will probably be physically impossible to spend it all within the twelve months under existing industrial conditions, but the fact that it has been voted, with such unanimity throughout the country, is striking evidence of the great importance which the people generally attach to our great highway program.

This work throughout the states will call for upward of 10,000 engineers in all grades—a figure that is probably underestimated rather than the reverse. This is an estimate made by Mr. MacDonald, Chief of the Bureau of Public Roads, some months ago, and includes only those who have, or should have, education and experience along civil engineering lines. The supply is far short of the demand, which means, of course, that in many sections of the country inexperienced and untrained men will be put in charge of the expendture of large amounts of money. The result will inevitably be a great economic waste. The universities and technical schools cannot turn these men out in sufficient numbers, of course, within a few weeks, and the falling off in enrollment during the war will limit the number of engineering graduates for two or three years to come.

With reference to the use of highways, increase in the number of vehcles of all kinds is a matter of such common knowledge that it need not be stressed. Passenger vehicles have multiplied many times in a very few years. This is undoubtedly one of the most potent causes for the increased interest in highway building. The increase in motor transport, however, while the actual number of motor trucks is very much less, raises a far more serious problem. The natural development of economic princples has led to a great increase in the capacity of single truck units. Where the driver's wages form a substantial part of the cost of operation, a 1-ton capacity truck means a higher rate per ton-mile than a 5-ton capacity truck, but it has been demonstrated that the 5-ton truck, or heavier, requires a much more expensve road than the lighter vehicle, for many of the older roads were badly torn to pieces by the heavy trucks. It seems reasonable, therefore, that if we add to the cost per ton-mile for operating the truck the legitimate overhead charges—interest on first cost of road, maintenance, rebuilding, etc.—the heavier truck would not show so great an economy. With our present system of highway construction, where is the economist who can tackle this question and determine how the cost of improved hghways may be equitably charged up to those who reap the chief benefit? Or else prove to the satisfaction of all taxpayers that a large initial expenditure is justified? Here is surely a research problem of the highest order.

The use of highways for motor trucking, a comparatively new activity well named "highway transport," is growing fast and "motor express" lines on a systematic basis will unquestonably be established in large numbers in the near future. Not only will this fill an important economic need, but it will furnish to young men of adventurous and roving tendencies opportunity for an active outdoor life wth plenty of the spice of variety and even a touch of danger that is so appealing. For some time past the Goodyear Company of Akron, Ohio, has operated a line of trucks between Akron and New York City. In talking last summer with one of their chauffeurs, I was particularly impressed with the point just made. The trucks are large and fitted with pneumatic tires. They travel normally at a pretty good speed, from 25 to 35 mi. an hour, and run continuously. Each truck is manned by a crew of two, who work in 6-hour shifts. A small bunk just back of the driver's seat permits the man off duty to get his rest, such as it is, while in case of an emergency both men must turn to and correct the trouble. The man I talked to was a wiry, snappy clear-eyed youngster, for whom it was evident the work had a peculiar fascination.

A development of highway transport of unusual interest has recently been carried out by one of the large manufacturers of motor trucks. This consists of an economic survey of a county in Pennsylvania which had in it no transportation faclities whatever other than highways. It so happened that there were no railways, either steam or electric, in the county, although it comprised many square miles of productive land. With the assistance and hearty support of the principal bank, two of the truck manufacturer's engineers made a comprehensive study of the entire proposition of getting the products of this county to the nearest railroad center and bringing back the commodities that were needed by the inhabitants. A final estimate was made of the number and capacity of the trucks that could be economically operated, a detailed statement of the routing, and an estimated balance sheet showing the probable return on the investment, as well as the great advantage to the community and possible stimulation to further productivity. The report was an admirable document in every way and was most suggestive as to the possibility along this line for many similar communities throughout the country.

It is difficult to point out, with any degree of

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The Highway's Part in the Development of Efficient Transportation*

By J. W. BROOKS†

I have no permanent foundation for the subject which has been assigned to me on this program. I am expected to discuss the highways' part in the development of efficient transportation.

Efficiency means that we must first have the facts. In this case the facts must necessarily relate to vehicle operating costs. Such costs cannot be determined until the road is constructed to such a degree of length and strength as to permit the determination of exact costs.

There are yet too many gaps of unsurfaced road—too many miles of poorly constructed, so-called modern roads—to permit our getting at vehicle operating costs with any degree of finality. For this reason any figures I might present would be only temporary in character. We cannot yet determine the highway's real part in the development of efficient transportation. We can at best only surmise what it may do.

So in presenting this subject in the brief time allotted this afternoon, I shall not deal in figures, but instead I shall endeavor to interpret the significance of certain tendencies that are now manifest.

In order to get at the subject in a manner most advantageous for the purpose in mind, we should understand, first, something of the economic forces which are creating a shift in traffic channels and forces that are increasing the traffic volume around our industrial areas.

We can start with this fact: Dependence upon the railway in the past as our sole transportation agent has resulted in the centralization of industry, first, because of the necessarily fixed terminal points, and, second, because of the opportunity which this dependence gave the railways to build up favored points by making favorable rates—a practice which in itself tended to still further concentrate industry.

Happily, that practice has been abolished, but we are still confronted with some of the evils which grew out of it. Concentration has increased around our producing centers to such an extent that we now have traffic congestion at peak periods. Our warehouses become packed, platform space has risen to a premium and ground values around our terminal points have been pyramided beyond all reason, with the result that higher tariffs become necessary to cover operating costs and interest charges on capital investment.

For all of this unnecessary pyramiding of costs the shipper has to pay, and to that he is forced to add a still larger amount on his own side as a result of freight delays, which in due time produces an adverse effect upon factory production.

It must be admitted that to a certain extent the concentration of industry around points where transportation could be tapped quickly was, and still is, an economic necessity. But industrial concentration as it now exists has reached a point, where, so far as its transportation is concerned, the law of diminishing returns has begun to operate. That is to say, tonnage movement has reached the point where it is being strangled, as it were, by railway inflexibility in local areas. In order to release this strangle-hold on transportation, the highway in its modern form comes into play as a part of our common carrier service. So, we are brought back to our subject—the highway's part in the development of efficient transportation.

Back in 1915, or about that time, an oil agent was stationed at South Bend, Ind. His territory covered principal points in the northern part of the state. His stock ran short and he raised Heaven and earth to get a tanker through by rail from Whiting—his base of supply. He finally succeeded in getting it into the local yards. It so happened that his office was located where he could look out of the window and watch the freight as it was shuttled about. He saw his own consignment bumped around a whole day before he could get at it. That experience drove him into a larger use of the highway to insure more efficient delivery of the product in which he dealt.

The experience of this shipper is typical of hundreds of thousands of others. It is experiences like this that constitute what we might call our "growing pains" in transportation development, and it is the accumulation of complaints like this that drove one railway president recently to exclaim that he wishes the tracks might be torn up for 50 mi. around every city and the local business turned over to the road and truck.

We "cuss" a lot and damn first one thing and then another like mule drivers on a crowded road, but out of it we are coming to an easier stretch in transportation, and we are coming to it through an enlarged use of the highway. Our "growing pains" have forced us into a realization that modern roads serve to decentralize industry, in that they make possible the removal of factories to more open spaces and hence lower ground values, while at the same time they shorten the time-distance to the freight car.

(Concluded on page 108)

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*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Manager, Educational Bureau, Federal Highway Council.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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THE CONVENTION

The American Road Builders' Association can safely take credit for having surpassed all its previous efforts in the convention and show held at Chicago last week. Road builders who have attended some of the former meetings of the association will realize how much that statement means.

That conditions were unusually favorable to the success of an undertaking of the kind in no way diminishes the credit due those in charge of the organization's activities. The work of putting on a show like that which filled the Coliseum and Annex is no light task, and its successful accomplishment demonstrates not only the effectiveness of the labor of the management, but also the commanding place held by the A. R. B. A. in the highway field.

While official records are not yet available, the numbers that crowded the registration desks, the throngs in the exhibition and the lack of vacant seats at the technical sessions indicated a total registration at least no less than those at some of the former most largely attended gatherings of the association. The large numbers present at all of the sessions were particularly noticeable. Beginning on the first day, with an attendance of more than twice the normal at the opening session, interest was maintained at the same pitch throughout the four days of the meeting. The program was followed very closely and the papers and addresses were of more than usual interest. If one adverse criticism were to be made of the convention, it would be the comparatve lack of open discussion from the floor. This lack, however, was perhaps more than compensated by the absence of the irrelevant addresses that sometimes have wasted the time of similar meetings.

The show was an unqualified success, from whatever angle viewed. There were approximately a hundred and thirty exhibits and their variety and the scale upon which some of them were made were never approached at any exhibition of a like nature. A fairly close estimate placed the value of the machinery and equipment shown at close to a half million dollars and it is probable that the actual business done by exhibitors exceeded all previous records.

Besides the commercial exhibits, there was a display by the Bureau of Public Roads that attracted much attention and added materially to the interest and educational value of the show. A demonstration of the methods of conducting tests of the impact of trucks upon road surfaces was made just outside of the exhibition hall one afternoon and an elaborate display of testing machinery and methods was maintained inside.

The entertainment and social features of the meeting left little to be desired. Special care was taken to provide entertainment for the women attending the convention and more were present at the session and at the show than at any meeting in other years. The dinner dance, making possible the presence of women at the annual banquet, was a pleasant variation of the former custom of holding a dance and a banquet on different evenings.

The selection of Chicago for the convention and show proved a happy one, practically unanimous approval being voiced by the exhibitors. The attendance was also doubtless conditioned largely by the accessibility of the city. Effective cooperation was given by the local committees, and the weather—always a dangerous factor in northern cities at this time of year—was all that could be hoped for and far more favorable than might have been expected.

All things considered, it was a great convention—one that can well go down in the annals of the association as a noteworthy achievement.

TROLLEY CARS NOT EXEMPT FROM OBEDIENCE TO ROAD LAWS

Hereafter, according to a recent ruling by the Connecticut Commissioner of Motor Vehicles, trolley cars in that state must obey the rules of the road.

The state laws provide that a vehicle approaching from the right always has the right of way. This was violated by a trolley car and a state policeman was killed.

If a universal rule of this sort is open to any such misinterpretation, clauses specifically denying exemption to street cars should be written into future measures. A trolley car is a vehicle and should be governed by any law relating to vehicles.

The Eighteenth Annual Convention of the American Road Builders' Association

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and such other committees of the carriers as may be deemed advisable

WHEREAS, the vital needs of transportation over our country highways call for the improvement of so large a mileage as to involve under any project a stupendous outlay by the taxpayers;

WHEREAS, the return to the rural taxpayer for his product has fallen to a perilously low level, and

WHEREAS, it lies with the producers of road materials together with the builders of highways to serve the greater transportation needs of the nation, lighten the burden upon the taxpayer and given employment to the many now on the verge of want, by a broad patriotic effort to lower road building costs, and

WHEREAS, there are many types and methods of highway construction which may be resorted to and which will bring about the competitive utilization of local materials and which will help to lower high prices and wasteful costs; now therefore:

BE IT RESOLVED by this American Road Builders' Association in Congress assembled in Chicago, that it is the sense of this body that a solemn obligation rests upon producers and contractors to meet the issue by lowering of costs of materials and operation to a point which will permit of the the greatest road building era in the history of America.

WHEREAS, automobile accidents on the highways and at grade crossings have caused the death of more than 5,000 persons and have resulted in injury to more than 14,000 persons during the past four years in the United States of America, a record unequalled by any other country, and

WHEREAS, these accidents have been due in many instances to lack of precaution and foresight in the construction of the smaller bridges, which has caused many heavily loaded cars and trucks to break through the bridge flooring, therefore

BE IT RESOLVED, That it be the sense of the American Road Builders' Association in convention assembled at Chicag, not only that there should be more and better highways, but safer highways.

BE IT FURTHER RESOLVED, That the use of the highways of the country as speedways by irresponsibles, maniacal speed lunatics be condemned and better policing be provided in the rural districts, and

BE IT FURTHER RESOLVED, That Congress and the the legislatures of the several states be importuned to provide better construction and inspection of bridges and to take such measures as are necessary to reduce to the lowest possible minimum the possibility of grade crossing accidents.

WHEREAS, since the last annual convention of the American Road Builders' Association we have suffered the loss of Joseph C. Rock, one of our oldest and most earnest workers,

BE IT RESOLVED, That this convention does hereby take formal notice of his death and expresses its sympathy to his immediate relatives.

BE IT RESOLVED, That this convention does hereby take President, Mr. Michael J. Faherty, its best and sincerest thanks and appreciation for the courtesies extended and efforts in making this convention the greatest and best ever held by the Association.

That a suitably worded and properly engraved testimonial setting forth these facts be prepared and presented to him by this Association.

WHEREAS, the 12th annual National Good Roads Show has been universally recognized as one of the greatest successes ever attempted; and

WHEREAS, its interest was greatly increased by the elaborate and complete exhibit furnished by the United States Bureau of Public Roads,

BE IT RESOLVED, by the American Road Builders' Association in convention assembled in Chicago in February, 1921, that this convention express its sincere thanks to the Bureau and that suitable testimony be sent to its Chief, Mr. Thomas H. MacDonald, expressing the appreciation for the efforts of this Bureau in helping to make the show the most instructive since its organization.

BE IT RESOLVED by the American Road Builders' Association in convention assembled in Chicago in February, 1921, that this convention go on record as strongly urging the passage by the Senate (it already having passed the house) of House Resolution 15873 which authorizes the immediate allotment for the fiscal year ending June 30, 1922, of $100,000,000 by the United States Government to be spent in Federal aid projects.

BE IT RESOLVED by the American Road Builders' Association in convention assembled in Chicago in 1921, that it is the sense of this convention that federal aid as now practiced be continued and extended and that federal aid be applied on such interstate highways as will ultimately form a national highway system.

RESOLVED, That the American Road Builders' Association express through the public press its deep appreciation of the many courtesies extended to the members of the Association by the Mayor and the most hospitable citizens of the City of Chicago, and

IT IS FURTHER RESOLVED, That the committee which decides where the next convention of the Association will be held be and hereby are requested to favorably consider Chicago as the place to hold the convention for the year 1922.

IT IS FURTHER RESOLVED, That a copy of these resolutions be forwarded to each of the several committees of the citizens of Chicago which made the convention of 1921 such a marvelous success.

BE IT RESOLVED by the American Road Builders' Association in convention assembled at Chicago, February, 1921, that the efforts by the various committees that are now working to solve the problem of stabilizing subgrades and completing the study of the relationship of subgrade to traffic and road surfaces should have the hearty support of this convention, and that every assistance be rendered from whatever source to speedily assist in solving this problem.

WHEREAS, the construction of highways in the United States has increased in the past few years by such leaps and bounds that today it is the largest construction enterprise in human history, and

WHEREAS, the American public has not awakened to the fact that it is a business enterprise that must be carried on along business lines and according to the best business principles, and

WHEREAS, the personnel of the state highway department has been in the past and to a great extent is at present controlled by the political faction that happens to be in power, thus resulting in the change of state highway officials every two years, therefore, BE IT RESOLVED by the American Road Builders' Association in Chicago at its 18th annual convention that the state highway departments should be removed from politics, that sufficient, competent and experienced contractors must be built up and at the same time the state highway departments must be built up along similar lines of efficiency and ability and the salaries of highway engineers must be increased to such an extent that practical and competent highway engineers can be secured and then retained in the various state organizations.

RESOLVED by the American Road Builders' Association in Chicago at its 18th annual convention that it is the sense of this convention that the Government of the United States of America shall become, without delay, a member of the Inernational Road Congress and the Executive Committee of this Association shall take the proper steps to have such legislation provided to accomplish this purpose and that every influence of this Association be placed behind such legislative acts before Congress as may bring about this desired end.

COMMITTEE ON RESOLUTIONS,
C. M. Upham, Chairman
S. E. Platt
H. G. Shirley
J. R. Draney
C. R. Eddy
W. P. Blair
J. A. Duchastel
Geo. W. Tillson
Dr. S. M. Johnson

The last business of the meetng was the appontment of the nominating committee. On motion by W. A. Howell the following committee was appointed: T. J. Wasser; T. H. MacDonald; C. M. Upham; H. G. Shirley; Fred Sarr; Frank B. Dunn; B. H. Waite; W. T. Headley; Zenas W. Carter.

Annual Banquet

The twelfth annual banquet of the American Road Builders' Association was held on the evening of Thursday, Feb. 10, and was followed by a vaudeville entertainment and dance. Brief talks were also made at the close of the dinner by Charles M. Hayes, Chairman of the Entertainment Committee and M. J. Faherty, President of the Association.

Entertainments

Besides the dinner dance on Thursday evening there was a theater party on Friday evening. There were also various affairs for the women in attendance, including a reception and tea in the Congress Hotel on Wednesday afternoon, an automobile sightseeing tour on Thursday afternoon, and a luncheon at the Drake Hotel on Friday afternoon.

Our National Highway Problems

(Concluded from page 99)

specifications can be made applicable not only to state but to county highway work, and the counties should have the benefit of the guidance and support of the state organization. The closer the correlation of the work of these two agencies, the greater service will be rendered to the public; and the more enduring and more generous will be the public support.

The fear arises that this discussion which started as a diagnosis, is becoming argumentative and confined too nearly to the economic and adminstrative rather than the engineering questions which are of national import. There is a too widespread feeling that our highways are not proving adequate under the traffic, and frequently newspaper scareheads appear that funds are being wasted. Examine any large program of construction honestly, and usually the only conclusion that can be reached is that the engineer has builded as well as the legislative and political control has allowed, and not infrequently the engineer who has produced the highest class results has been displaced because of his inability to stretch the dollars into a larger mileage of roads. In many large programs recommended engineering policies have been mutilated beyond recognition through an attempt to meet the apparent public demand for more miles of roads. During the past year great progress has been made in directing public attention to the fact that highways must be designed with painstaking care and with scientific knowledge of the local conditions which must be met and this is perhaps the greatest of our national highway engineering problems today—the design of highways which will use the most available materials—which will take into consideration not generally but specifically, the soil and drainage conditions, the topography and all other local physical facts which bear upon the durability and cost of the construction.

Let it be clearly understood, however, that the engineering and the economics cannot be separated, and that that engineering is best which does not design against every possible failure at an impossible cost, but which limits the number of failures to a low per cent.

A major engineering problem which is natonal in its scope is the early determination—by agreement, if possible, between the road user and the road builder—of the maximum loads which are to be carried. Although our motor vehicle registration has reached over 9,000,000 vehicles, the determining factor in the design of the higher cost roadways is the motor truck which now constitutes not more than about one-tenth of the motor vehicles registered. A recent traffic count in California shows that the use of the highways by motor trucks amounts to aproximately 12.5% of the total traffic. There is no doubt that the design of motor vehicles has been treated largely from the mechanical consideration of the construction of the vehicle itself. The development of these vehicles has taken place so rapidly that the adaptation of the vehicle to the roadways over which it is to be operated has been seriously neglected. On the other hand the highway engineer is forced to give consideration, in his design of modern highways, to the vehicles which are to be operated over them, and it is now time that the inter-relationship of the design of highways and the design of motor vehicles be recognized as a fundamental engineering problem without which the development of neither can go forward in a manner that will bring to the public the greatest service from the combination.

Relation of the Highway and Motor Transport Movement to Education

(Continued from page 101)

certainty the educational need in connection with such a rapidly changing and quickly developing activity as that of the construction and use of highways. One point has already been touched upon, and that is the need of trained engineers to undertake highway construction as a public service. The idea of public service, of the importance of the highway program as a part of public service, cannot be overstressed. At the meeting in Washington last May, called by the Commissioner of Education for the purpose of considering current needs in highway education, it was estimated that for the next three years there would be about 1,100 civil engineering graduates turned out each year. Many of these will go into structural engineering, a number into sanitary work, or other branches of the profession, and a great many—indeed, the majority of them, if we can trust the statistics of years past—will turn to business or other work not connected with professional engineering. On the basis of the 10,000 or more engineers needed, which is admittedly conservative, and on the further basis of an annual "turn-over" in this force of 10%, we have at the very least a thousand civil engineering graduates who could be absorbed annually by this highway work. This, be it remembered, is the work with highway construction, and does not include any other activities, such as the management and operation of highway transport lines. The enrollment is increasing in our technical schools in a gratifying way, but the boys who are entering now will not be available for three or four years. There is a tendency on the part of engineering students to shy away from highway work because the subordinate positions do not pay as well as those in some other lines, but the higher places, which can be reached only through experience, are well paid, and the present tendency of certain states and counties to offer substantial salaries to their chief engineers and principal assistants will in time attract the attention of students.

With one or two noteworthy exceptions nothing has been done by the universities and technical schools to prepare men for the business of motor transport, such as is done, for example, in railroad administration and operation. Perhaps this is inevitable. It may be that the need and the opportunity must be more apparent before there will be sufficient demand on the part of college students to justify the establishment of specific courses. There is another side to that, however, and that is the chance that the colleges have to take the initiative, show the wonderful opportunity there is in the field and point out in carefully planned courses of study the rational basis and underlying business and engineering principles of motor transport activites. In other words, instead of letting the busness grow up and then fitting men to take care of it, why not train men to establish, promote, and manage the business which is undoubtedly there simply waiting to be developed?

One of the exceptions noted above deserves special mention. A strong highway department has recently been established at the University of Michigan, under the able direction of Prof. Arthur H. Blanchard, the well known highway engineer. The department offers carefully planned courses in highway transport engineering as well as in the older fields of highway construction and maintenance. With well equipped laboratories and a large student body, and located in the center of a community which has always supported roads generously, the new department has a most promising future for rapid and useful development.

Complaint has often been made that our modern systems of education destroy the imaginative power of the young instead of stimulating and developing it. In engineering and in those businesses and industries which are based more or less definitely upon engineering, there is nothing so valuable, and nothing so important, as creative imaginative power. What is the best way of developing this quality in a youngster? Or is it something that is born in a child and is then tried and stunted and held back by all the so-called educative processes of those wonderful 15 or 18 years, to be finally either completely educated out of the youngster or else emerge triumphant to really do things in the world in spite of grammar school, high school and college? In that most interesting book by H. G. Wells, "Joan and Peter," he says: "There is something heroic about the fight that every infant mind has to make against the bad explanation, the misleading suggestion, the sheer foolishness in which we adults entangle it." Certainly some of the courses which are given in modern schools seem to be directed to the end of breaking down the creative and imaginative power of the youth's mind and making it conform to accepted types of thought and action. Processes which bring out or call for creative effort on the part of students are rather rare, the principal mental quality developed being the absorptive one. Mr. Dooley has given an entertaining description of the

(Concluded on page 108)

MEETINGS

Calendar of Coming Meetings

Feb. 21-23—Minnesota Surveyors' and Engineers' Society.—Annual convention, Hotel Commodore, St. Paul, Minn. Secretary, C. H. Stewart, 811 Guardian Life Bldg., St. Paul, Minn.

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 23-26—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

New Jersey State Highway Department Will Hold Convention

The New Jersey State Highway Department will hold a convention at Trenton on Feb. 23, 24, 25 and 26, and state and county highway employees, contractors, and others interested in road building are invited to attend. Several state officials from other states have been invited to make addresses.

An exhibit of highway materials has been prepared by R. B. Gage, State Highway Chemist and will be opened to the public at the laboratory of the department in Trenton. This exhibit will also be used for the instruction of the department's inspectors.

"I anticipate that much of value to the state in its road building program will come out of this convention," said State Highway Engineer Wasser in announcing the convention. "It will be the first time that all the men engaged in this state enterprise, either in the capacity of public employees or private individuals having public contracts, have been assembled together for a full and free discussion of views and opinions. One of the features will be several lectures and talks by representatives of the department to the forces of our inspection and engineering departments regarding the quality and character of materials to be used in state highway contracts, with special attention as to how these materials may be recognized and judged in actual road building work and the tests necessary to determine whether they have the desired standard specifications. Emphasis will be laid particularly on the subject of how pavements can be injured by use of inferior materials and improper methods of highway construction."

Associated General Contractors of America

The annual convention of the Associated General Contractors of America was held in New Orleans, La., on Jan. 25, 26 and 27. The following officers were elected for the ensuing year: President, W. O. Winston, Minneapolis, Minn.; Vice Presidents: F. L. Cranford, Brooklyn, N. Y., Arthur Bent, Los Angeles, Cal., Daniel Breck, St. Louis, Mo., W. E. Wood, Detroit, Mich., J. W. Cowper, Buffalo, N. Y., L. C. Watson, Boston, Mass.; Treasurer, Lee Paschall, Richmond, Va.; Directors: N. F. Hoggson, New York, N. Y., W. A. Starrett, New York, N. Y., G. O. Muhlfield, Boston, Mass., J. R. Wiggins, Philadelphia, Pa., G. C. Mason, Portland, Ore., Richard McCarthy, New Orleans, La., A. E. Wells, Chicago, Ill., Charles Folliott, St. Paul, Minn., H. B. Hanger, Richmond, Ky., E. J. Thomas, Memphis, Tenn., George Watson, Dallas, Tex., M. D. Smith, Detroit, Mich.

University of Michigan Highway Conference

The seventh annual conference on highway engineering and highway transport of the University of Michgan will be held at Ann Arbor, Mich., on Feb. 21 to 25, in cooperation with the Michigan State Highway Department. The program is as follows:

On Monday afternoon, Feb. 21, Frank F. Rogers, State Highway Commissioner of Michigan, will present a paper on "Proposed Highway Legislation," and Leslie H. Belknap, Chief Engineer, Michigan State Highway Department, a paper on "Necessity for Increased Transportation Facilities for Construction Materials."

Four papers will be presented on Tuesday, Feb. 22, viz. "Alignment of Improved Highways," by L. H. Neilson, Deputy State Highway Commissioner of Michigan; "Conditions Under which Guard Rails Should be Used," by W. W. Cox, Engineer-Manager, St. Clair County Road Commission; "Plant Inspection, a Necessity to Insure Good Bituminous Pavements," by Francis P. Smith, Consulting Paving Engineer, New York City; "Visible Records on Maps," by Victor R. Burton, District Engineer, Michigan State Highway Department. On Tuesday evening a smoker will be given and Phillip T. Colgrove, President of the Michigan State Good Roads Association, will speak.

On Wednesday, Feb. 23, the mid-western conference in cooperation with the Highway and Highway Transport Committee of the U. S. Bureau of Education will be held. The program for this conference was printed in the Feb. 9 issue of GOOD ROADS.

A road commissioners' meeting will be held on Thursday, Feb. 24, with Frank F. Rogers, State Highway Commissioner of Michigan, presiding. In the morning representatives of the several county highway departments of the state will report on progress in their respective counties. In the afternoon the problems of county and township road work will be discussed.

An informal dinner will be held Thursday evening by the Michigan Road Commssioners' and Engineers' Association, with G. W. Schneider, President of the association, presiding.

The last session of the conference will be held on Friday morning, Feb. 25, with two papers, "The Administration and Organization of Maintenance Work for State Trunk Highways," by A. H. Hinckle, Chief Engineer of Maintenance, Indiana State Highway Department, and "Methods of Dust Prevention and Preservation for Maintenance of Gravel Roads," by G. C. Dillman, Maintenance Engineer, Michigan State Highway Department.

PERSONAL MENTION

Leon C. Herrick has been appointed state highway commissioner of Ohio.

George A. Grierson has resigned as minister of public works of Manitoba, Canada, because of poor health.

Arthur S. Tuttle, Deputy Chief Engineer of the Board of Estimate and Apportionment of New York, N. Y., has been appointed chief engineer, succeeding Nelson P. Lewis, resigned.

Relation of the Highway and Motor Transport Movement to Education

(Concluded from page 106)

interview between a fond parent and the president of the college in which the boy has just been entered. After the necessary preliminaries regarding name and age, the college president asks, "And which one of our high-priced professors would you like to have do the lad's thinking for him the next four years?"

The highway field offers numberless opportunities for educational work, and the growing importance of its various activities would seem to warrant more attention on the part of schools. It would be well if every school-boy, and school-girl too, could be taught something about the highways of their own town, county and state. Such teaching would appeal strongly to their youthful imaginations, for even the country road past the school house, coming as it does from far away and going on to the other towns, or distant mountains, or the ocean, or great cities, can have a peculiar fascination. If an interest fostered by such ideas could be made to lead to an understanding of more practical questions, such as how the highway is built, what are the laws concerning it, who pays for building it and keeping it in repair, so much the better. These are questions which every voter must face some time, and if school children and college students think and study about them they will vote more intelligently when the time comes for them to vote. As a consequence we shall have better roads and more intelligent expenditure of public funds.

The Highway's Part in the Development of Efficient Transportation

(Concluded from page 102)

Now the point of particular interest to you gentlemen in this matter is that the road builder must precede the rate-maker before the road itself can be brought to that degree of efficiency to which it must ultimately come if it is to play a real part in developing efficient transportation. I am familiar with the argument that motor vehicles go first and road improvement afterward. That has been true, but it does not alter the fact that whenever the motor vehicle has been shoved ahead of road consruction there has been great waste in vehicle operation. And this waste—we must agree—could have been avoided had the roads preceded the truck. Which brings us back again to our main point; that in order to make the highways play their part efficiently the road builder must precede the rate-maker.

Motor express line promoters bump into this fact every time they try to sell stock. About two years ago I ran into a very rosy prospectus of this kind here in Chicago. A few gentlemen had set about to organize a $5,000,000 corporation to operate five highway freight and express lines out of this city. They had "figures to burn" on the advantages of the motor truck for less than carload lots, but every time they got a prospect around to the point of signing a check for stock, the question came up "But how about the road? Can your truck run on schedule at a minimum fuel cost so you can make money?"

Right there a monkey wrench was thrown into the deal. These promoters had several experiences of that kind, and they finally decided to consult the county highway engineer and see if they could find a stretch of road that would fit their plans, insure dependability and give them a stretch sufficient in length to make even one route pay. They could not find it, and the project was abandoned after more than $5,000 had been spent in preliminary work.

It is very clear, gentlemen, that highway transportation cannot function efficiently until you have gotten through with the construction of the road. Until you have filled in the gaps and brought the whole up to modern requirements in the form of complete state and county systems, any figures I might present on the part the highway can play in the development of efficient transportation, would be mere conjecture at best.

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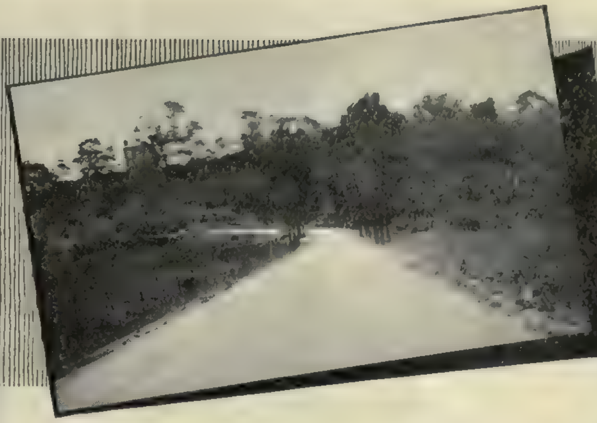

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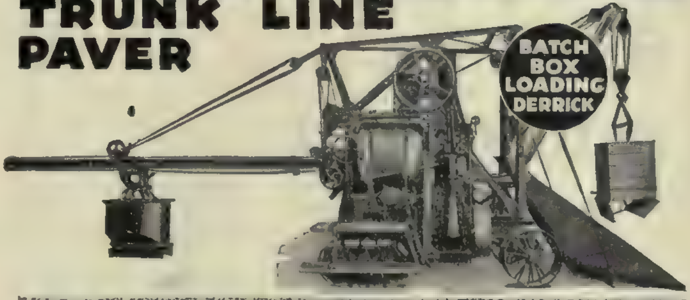

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Old Series, Vol. LX
New Series, Vol. XXI

JAMESTOWN, N. Y., FEBRUARY 23, 1921

Number 8

Pre-cast Concrete Slab Pavement on Salt Creek Road in Wyoming

By C. H. BOWMAN*

A stretch of 2,400 ft. of experimental pre-cast slab concrete pavement was laid in place and put in service between Casper and the Salt Creek Oil Field on State Highway No. 71, during the month of December, 1920.

Oil was discovered in 1886 in the Salt Creek Oil Field, 44 mi. north of Casper, now known to be one of the best fields in the world, from a producer's standpoint. Active development of the field started in 1911. With the beginning of drilling operations the trail between Casper and Salt Creek was soon lined with many string teams hauling building material, oil well and commissary supplies. In the year 1916 the first motor truck made its appearance on the trail. Teamsters, with their 16 to 24-horse string teams, who had struggled with their loads of freight across the sticky gumbo flats during the spring thaws and across the sandy stretches in the hot, dry summer months, predicted speedy disaster to the interloper. However, despite high centers and bad road conditions this truck stayed with the game and from that time on trucks increased rapidly in number, while the number of string teams decreased correspondingly. With the arrival of more trucks in the hauling fields the agitation for road improvement began and as a result, in 1917 the county, state and Midwest Oil Co. joined in a federal aid project reaching north from Casper 39 mi. This 39-mi. stretch was graded and provided with proper drainage structures and the first 5 mi. north of Casper were paved with concrete, 16-ft. wide, this work being finished in 1919. During 1920 the remaining 5 mi. to Salt Creek was graded and drainage structures installed preparatory to paving.

While these improvements greatly facilitated the motor vehicle traffic, the great increase in number of vehicles made the transportation problem an increasingly difficult one. By late spring of 1920 the tonnage passing over this road had increased until

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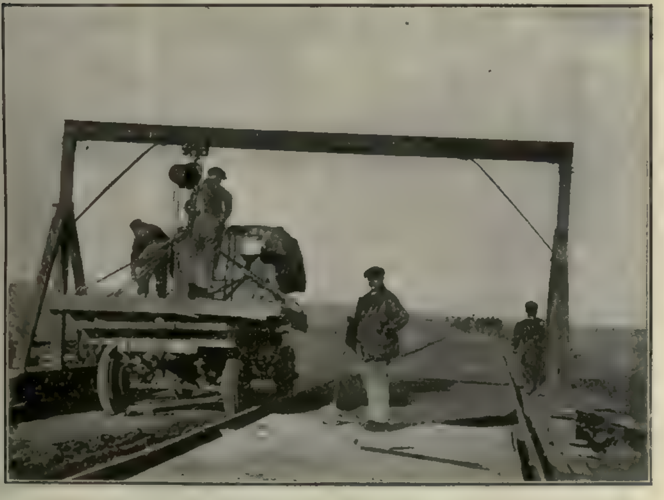
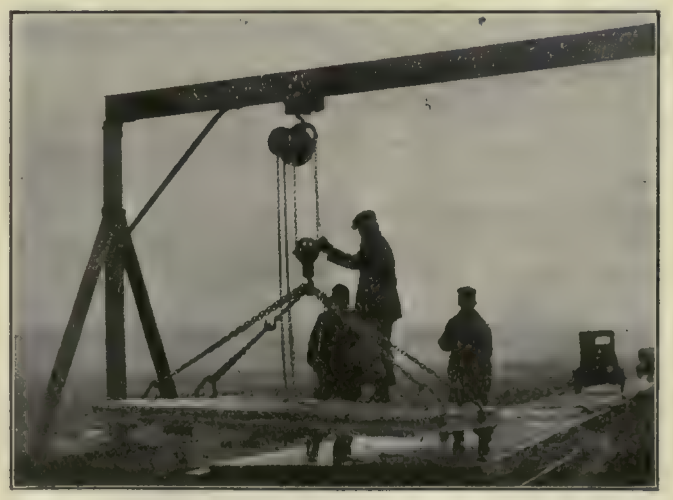
*District Superintendent, Wyoming State Highway Department.



Unloading Slab from Truck



Placing Slab in the Pavement

LAYING A PRE-CAST CONCRETE SLAB PAVEMENT ON THE SALT CREEK ROAD IN WYOMING in a single month the Midwest Oil Co., the leading producing company in this field, loaded out 6,000,000 lb. of freight from their warehouses. A very conservative estimate of the tonnage hauled by other companies during the same month is 4,000,000 lb. Add to the motor trucks required to haul this tonnage another 100 motor vehicle per day passing over this main north and south state road and the necessity for a hard surface road of the very best type is apparent.

Plans were made by the State Highway Department for a concrete pavement on the remaining length of unpaved road, 39 mi., to Salt Creek. Thorough investigation of the country on both sides of the road developed the fact that the only source of supply for aggregates was in the gravel bars of the Platte River at Casper and that there was no dependable source of water supply anywhere north of Casper on this road. The long haul for aggregates and other materials, the necessity of a heavy expenditure for pumping plant and the scarcity of labor during the post-war conditions of 1918 and 1919 prevented the State Highway Department from going ahead with this work.

While the State Highway Department was conducting studies of the surfacing problem on the Salt Creek Road, the idea was conceived of casting this pavement in slabs at Casper, the source of aggregate and water supply. By so doing the pavement could be placed at a minimum of interference with traffic, a minimum of camp expense, a minimum of equipment expense and a minimum of labor. War Department trucks of the Maintenance Division of the State Highway Department were available for the hauling.

The Midwest Oil Co., and the Bureau of Public Roads were asked to contribute 50% each to the construction of this pre-cast slab pavement. There were many "Doubting Thomases" as to the probable success of the undertaking, but the state highway superintendent, D. S. McCalman, finally got the approval of the Bureau of Public Roads for an experimental section 2,400 ft. long, the Bureau paying half the cost and the Midwest Oil Co. the other half.

The state law of Wyoming provides that state highway construction work of more than $2,000 shall be done by contract. As there was plenty of work for contractors at high prices, great difficulty was experienced in letting a contract at reasonable prices on this proposed new type of pavement. However, in September, 1920, a contract was let by the State Highway Department to the Levy Construction Co., of Denver, Colo.

Reinforced concrete slabs, 8x9 ft. and 6" thick, with wire mesh and bars were designed by the State Highway Department and approved by the Bureau of Public Roads. Six different types of joints were planned, giving a trial section 400 ft. long for each type of joint. Type "A" joint consisted of a reverse curve, warped surface with radii of 9 ft. 10 in. and 8 ft. 1 in. Type "B" was similar but with the two curves of the warped surface having radii of 4 ft. 8 in. and 6 ft. 5 in. Type "C" joint was ordinary right angle joint. Types "D" and "E" joints had a batter of 2 ft. 9 in. and 1 ft. 9 in., while Type "F" had four sets of interlocking U bolts locked with a ⅝-in. rod. All joints were to be sealed with a bituminous filler.

The pouring of the slabs did not start until October and before the pouring was completed in November there was considerable freezing weather and temperatures as low as 12 above zero were recorded. While the work was handicapped by snow and cold weather the aggregates and water were heated to prevent freezing.

The slabs were laid in December, during which month there were several snow storms and the thermometer went to 6 below zero. Anyone who knows the Wyoming winter, with its constant high winds, will realize that conditions for slab laying were far from ideal. This work was under the very close supervision of the State Highway Department and the hauling was done with the state trucks by the Maintenance Division.

The loading and unloading apparatus consisted of 10-in. I-beams for trolley tracks mounted on frames. Three-ton trolleys with 3-ton Triplex chain hoists were used for raising and placing the slabs.

The cost of casting was high on account of the experimental nature of the work and the high overhead for the amount of pavement cast, as well as the cold weather conditions encountered. The cost per yard would have been greatly reduced on a larger contract, as the Levy Construction Co. bid just twice as much per yard for casting a 2,400-ft. section as they did for casting a 2-mi. section. The cost of preparing the subgrade was high because of frequent freezes, but as the soil where the pavement was laid was very sandy, no trouble from heaving was anticipated. The hauling cost, allowing $6 per day for depreciation on each truck, was 39 ct. per ton-mile.

This 9-ft. slab pavement has been laid on the one side of the center line of 24-ft. roadway so that another strip of the same width can be added on the other side of the road.

At this writing heavy truck traffic has been passing over the pavement for several weeks and the very excellent surface of the pavement does not yet show any sign of the displacement that some critics feared. The relative values of the different types of joints cannot at this time be determined, although apparently the interlocking joint is the least desirable.

While the real value of such a pavement on a heavy

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Subgrades*

By H. G. Shirley†

Much is being said on this question at the present time, but its importance justifies bringing it clearly to the attention of every highway engineer, road builder, and the public, in such a manner as to insure a thorough investigation and proper solution. The speaker no doubt will be criticised for the things he will say, because many consider it a relfection on their road building ability if any one suggests that there should be some change in the standard method of construction that is being used at the present time. But having been a highway engineer for a number of years and having built a large mileage of roads, he feels that any criticism that may come from this angle will have to be borne by him along with his brother engineers, but will be for the best interest of all. He does not believe, however, that those who take this view are looking at the problem from the proper standpoint. There should be no criticism, but a thorough and honest discussion of the problem. The greatest virtue in all discussions is honesty, and we must, therefore, approach this subject with a view to laying it bare, regardless of whom it may hit, for it will not be solved until it has been aproached in this way.

Therefore, in discussing this subject the speaker wants to be understood as not criticising anyone, or the type of construction, but as merely pointing out to the road builders of the country a vital problem that is greatly in need of solution, and to make a few preliminary suggestions in that direction.

The necessity for an intensive study of the subgrade was not as pressing in the past as it is at the present time and will be in the future, because traffic units had not increased to such a weight that the crust of the highways was destroyed, and, therefore, a fairly thin surfacing would render quite efficient and lengthy service. However, the speaker wishes to point out that even then these surfaces were not designed so as to carry the maximum wheel load over the entire section, but were of a uniform thickness rather than a uniform strength—some places being entirely too thick and others entirely too thin.

Very likely the speaker will be accused of attempting to justify the use of the heavy truck, and of acquiescing in the charge that the destruction caused by the heavy load can be attributed more to the improper construction of the road than to the weight of the load. But what he wishes to be understood clearly on, is that he believes the heavy load is one of the prime factors in destroying many of the surfacings of the highways that have heretofore been constructed; and that, therefore, some limit as to its weight and the speed of the vehicle should be arrived at and agreed upon as soon as possible. He is not in a position to say what the gross weight should be, but he believes the problem should be approached with an open mind from both sides, and that the economic unit should be one that will preserve the roadbed, and yet be an efficient unit to operate. Whether this will be a 3-ton, 5-ton or 7-ton truck, he does not attempt to say, but regardless of what the weight of the load and vehicle may be, the subgrade problem is just as important from the standpoint of a 3-ton truck as it is from the standpoint of a 7-ton truck, because it is purely a problem of proper design and one that will have to be solved before any intelligent design of the surfacing can be arrived at.

When the speaker reads of the adoption of a standard specification calling for a uniform thickness over all classes of soil, he cannot but feel that there is something radically lacking in the adoption of any such standard, and if it is persisted in, rather than a standard of uniform strength, there will be written some of the blackest pages ever recorded in engineering history, and many of the thoughtful engineers of the country will bow their heads in shame.

The crying need, so far as that need can be seen at the present time, is to build a road that will have a uniform strength, so as to carry a specific load over its entire length without danger to its structure. We all know that on gravel and other stable soils with a high bearing power, a thick surfacing will not be required, whereas on soils consisting of clay and adobe a very much thicker surfacing will be required to carry the same load at certain seasons of the year. Why, then, should we persist in laying the same thickness of surfacing over the clay and adobe soils that we lay over gravel and other more stable materials? Millions are being wasted annually in placing a greater thickness of material in places where it is not needed, and in other places where a greater thickness is required, in not putting sufficient depth. The consequence is that in the places where there is not a sufficient depth of material the surfacing will go to pieces under the load, thereby causing enormous expense for its reconstruction.

It may be of interest at this point to note that the failures that occur on the soils of high bearing power run about 17%, whereas under the same climatic and traffic conditions, with the same thickness of surfacing, made of identically the same materials, on soils of low bearing power, such as clay and adobe, the failures run up to 70%. On stable gravel and sandy soils the failures ran as low as 2 to 3% and they were very likely due to workmanship and not to foundations.

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*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Secretary, Federal Highway Council.

From this it can be seen that the uniform distribution of the material over the subgrade was an absolute mistake. In sections it could have been thinner, and over the weak clay and adobe sections it should have been made thicker. Of course, this would not have shown up if heavy traffic had not gone over these highways, for we all realize that almost any kind of surfacing would be capable of carrying a large volume of baby carriage traffic. If the highway is to be built to serve the community and be a means for transportation, then it must be built of sufficient strength to carry, in an economic way, the commerce of the section it serves.

The speaker believes the two most important problems of highway transportation and construction that face the country at the present are the determination of the weight of the moving load that can be carried, and the bearing power of the different types of soils of the subgrade. When these two factors have been determined, plus a reasonable percentage for impact due to speed, then we can proceed to design the surfacing with a reasonable assurance that it will carry the load that has been specified without breaking down in many places and costing the public a large amount of money to repair annually.

Thomas H. MacDonald, Chief of the Bureau of Public Roads, and A. T. Goldbeck, Testing Engineer, fully appreciate the great importance of this problem, and are devoting a great deal of energy and time to its solution. The bureau has under investigation many important features bearing on this subject, and is doing most excellent work. It deserves your earnest cooperation and support. It is only through such a channel that we can look for this problem to be solved quickly, and it is the duty of those interested in highway construction and highway transportation, and the general public, to assist in every way this investigation and to see that the Bureau of Public Roads is supplied with sufficient funds to carry on this work expeditiously. The Subgrade Committee of the Federal Highway Council is cooperating to the extent of its ability with the Bureau of Public Roads and the leading universities and colleges of the country, as well as many of the State Highway Departments and testing laboratories, in an effort to stir up as much interest as possible in this subject. By working together the problems can be approached from many angles and a most satisfactory solution arrived at speedily.

The outline of the problems being taken up by the Problem Committees of the Council are as follows:

Problem 1. Securing of samples of the subgrade materials at points where the failures have occurred and samples where failures have not occurred in the same vicinity under similar conditions.

Problem 2. Developing field tests for bearing power of soils.

Problem 3. Making studies in drainage, using experimental sections of roads.

Problem 4. A study of chemical methods of subgrade treatment for increasing bearing value or preventing absorption.

Problem 5. A study of mechanical methods of subgrade treatment.

Problem 6. A study of freezing and thawing on the volume and on the supporting properties of soils.

Problem 7. A study of the effect of moisture on the volume changes in soils.

Problem 8. A study of the transmission of pressure transmitted to the subgrade through different thicknesses and different types of surfacing.

Problem 9. A study to assist in the practical classification of subgrade materials.

Problem 10. Special problems.

The method of procedure has been outlined by each Problem Committee so that the members of the entire committee and those who are making similar tests in other institutions and laboratories will have a direct line of investigation. It is hoped that the results secured from these investigations will be in such shape that they can be checked up and a final conclusion arrived at. However, it is absolutely essential that a great number of experiments should be carried out, both in the field and in the laboratory. Instruments will have to be made to test the bearing power of the different types of soils; drainage systems will have to be designed to keep the water from getting to the subgrade, rather than taking it away after it once gets there; and mechanical and chemical treatments will have to be undertaken to see which methods will give the best results under certain conditions.

The samples taken should be 1 cu. ft. in volume and should be taken directly under the failure, if possible. Also all accompanying data giving the general topography of the surrounding sections, drainage conditions, type and character of workmanship used in building the roadway, photographs of the failure, and the general conditions surrounding, as well as a full description of the traffic passing over the road, should be secured. Samples are also to be taken in the near vicinity, under similar conditions, from a secton of the road that has withstood traffic, with all the accompanying data given as above. These samples will be tested to determine their behavior and bearing value under many conditions. First, the amount of water contained in the soil, when samples are taken, and also the volume of water when it has been saturated; the change in volume due to the varying amounts of water; change in volume due to freezing and thawing; void spaces in the soil; the rate and extent of percolation through the soil; the rate and extent of percolation both horizontal and vertical; organic matter in the

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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THE CHICAGO ROAD SHOW

The Twelfth National Good Roads Show, was, without doubt, the most complete and extensive exhibition of the kind ever held in this country — probably the greatest ever held anywhere. It included practically everything used in the construction and maintenance of country roads and city streets, both in the way of plant and materials. Many of the exhibits consisted of contractors' equipment of various kinds and included not one, but in most cases, several makes. Most of the machinery was kept running and all displays were so arranged as to permit of the closest inspection. Representatives of the manufacturers and dealers were in attendance, ready and willing to explain and demonstrate.

The value of such an exhibit to officials, engineers and contractors—especially, perhaps, to the last named—can hardly be over-estimated. The successful prosecution of road and street work is becoming more and more dependent on plant, and the up-to-date contractor must know what is obtainable, what it costs and what can be done with it. These data can be secured at an exhibition like that held in Chicago at less expenditure of time and money than by any other way.

POLITICS IN HIGHWAY APPOINTMENTS

Within the next few months the usual periodic shake-ups in some of the state highway departments will take place. Many able, experienced highway officials and engineers will be turned out to make room for new men, some of whom will be trained and experienced road builders and some of whom will be men without previous training or experience in the work. These new men will serve for a year, two years, several years perhaps, and then, just as they have attained skill in their work, will have to step down to let in a new set.

The same thing, but more of it, will happen in the counties, the towns and the cities. Good men with several years' experience will be replaced by other men, equally good, no doubt, but frequently with little or no experience and sometimes without other qualifications for the work they will be called upon to do.

The reason, in every case will be that the man who goes out holds the wrong political faith, while the new man is of the faith of the administration.

So long as this system lasts, so long will the states and the nation be without the highway systems they should have. So long as this system lasts, so long will it be difficult to get very many of the best engineers to serve the public in road organizations. There will always be a few of the ablest engineers in state and county highway departments and in the street departments of the cities, but were road work on a different basis, both as to tenure of office and pay, high grade engineers in large numbers would be attracted to it as a life work.

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Reno County, Kansas, constructed 20 mi. of paved roads during 1920. In addition, considerable grading has been done preparatory to paving.

Cities and Towns in Iowa let contracts in 1920 for approximately 1,843,000 sq. yd. of paving at a cost of over $6,470,000, an average of $3.51 per square yard. The City of Des Moines let contracts for 152,682 sq. yd. at a cost of $591,865, an average cost of $3.87 per square yard.

The Salt River Bridge in Gila County, Arizona, has recently been completed under a cooperative agreement between the National Forest Service and the county supervisors. The bridge is located on the Salt River-Pleasant Valley Road, in the Tonto National Forest, and crosses the Salt River near Livingston. Its construction will make it possible to do away with a dangerous and inconvenient ferry across Roosevelt Lake. The work was done, under contract, by the El Paso Bridge & Iron Co., at a cost of $42,081.79, which was met equally by Gila County and the Forest Service.

Pre-cast Concrete Slab Pavement on Salt Creek Road in Wyoming

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traffic road can be determined only after several years' trial, a service has been rendered to the engineering profession in demonstrating that a precast slab pavement can be successfully built. In future years short stretches of soil requiring pavement on otherwise good gravel or dirt roads and roadways in desert stretches may be paved in this way.

Ohio Holds Up Highway Contracts

The last letting of road contracts on Dec. 31 by the Ohio State Highway Department, involving about $3,000,000, is being investigated by Governor Davis and the legislative reorganization committee. Leon C. Herrick, recently appointed state highway commissioner, has been instructed to hold up these contracts and call for new estimates.

Commenting upon this action, A. R. Taylor, former State Highway Commissioner, declared that these contracts had been let and signed and could only be invalidated by court action.

Congress Will Appropriate More Federal Aid Funds

A bill calling for an appropriation of $100,000,000 additional federal aid funds and $3,000,000 for roads in national forests has been substituted for the McArthur bill, has been reported favorably by the House of Representatives Committee on Roads and passed by the House. The bill will now be referred to the Senate Committee on Post Offices and Post Roads, and although some opposition may develop, as to the form which federel aid legislation should take ,it is expected that the measure will pass the Senate.

Hudson River Bridge Corporation Formed

The Hudson River Bridge Corporation was recently incorporated in New York, with a capital of $281,000, to build a double deck railway and highway toll bridge over the Hudson River at 57th St., New York City.

The plan involves the erection of freight and passenger terminals, elevated railways, highway and railway bridge and moving platforms. It is estimated that the project will involve the expenditure of $200,000,000. The directors are G. F. D. Trask, George T. Smith, R. A. C. Smith, George A. Post, John H. Love, Henry D. Warbridge, Thomas H. Simpson, Fulton MacMahon and W. J. Amend. An organizing committee of 100 has been formed to lead a public movement in support of the enterprise. When started, the structure would take about eight years to complete.

Oregon Sells Road Bonds at 92.50

The Oregon State Highway Commission recently sold $1,000,000 of bonds bearing 4½% for 92.50 to Cartens & Earles, Inc., and William R. Compton & Co. This is the highest price received during the past year, the last lot of $500,000 of bonds being sold for 90.71.

Street Work in Shreveport, Louisiana

During 1920 the City of Shreveport, La., spent $600,000 in improving city streets, according to H. E. Barnes, City Engineer. The program for street work in 1921 provides for the letting of 40,000 sq. yd. of paving, in addition to 100,000 sq. yd. already contracted for.

Daniel Webster Highway

The New Hampshire Bar Association is planning to have introduced in the Legislature a bill providing that one of the three main roads running through the state be named the "Daniel Webster Highway." Considerable sentiment has been created in favor of that name for the road that runs from Nashua through Manchester, Concord and Laconia and thence north to Canada.

Connecticut Trolley Cars Must Obey Road Rules

Trolley cars in Connecticut must obey the state regulations for highway traffic, according to a recent ruling of Motor Vehicle Commissioner Robbins B. Stoeckel. The point was raised following an accident in which a state policeman was killed when an electric car did not wait for an automobile proceeding from the right.

Many Slides on Oregon Highways

The recent heavy rains in Oregon have caused many slides on highways in that state, causing damage to the extent of $100,000, according to Herbert S. Nunn, State Highway Engineer. It is estimated that approximately 100,000 cu. yd. of earth must be removed from various highways.

Heavy slides are reported on both the upper and lower Columbia River Highways, with particularly heavy slides on the upper highway between Hood River and Mosier. On the Roseburg-Myrtle Highway about 20,000 cu. yd. of earth were washed down and at one time a considerable part of the road between Monroe and Junction City was under water.

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Precinct 7, Cass County, Texas, passed a road bond issue of $35,000 on Dec. 16 by a majority of nearly three to one. This sum, added to other funds available, makes a total of about $185,000 for road work.

Interest on California Road Bonds Raised to 5½%

An interest rate of 5½% on $3,000,000 of road bonds has been fixed by the recently organized State Highway Finance Board of California and the bonds will be sold shortly. This is the first action of the new board, which is empowered to fix the interest rate on bonds, not to exceed 6%, according to market conditions.

Many Bids Made on Maryland Bonds

Eight bids were received on $2,500,000 of Maryland state bonds bearing 4½% interest, the highest bid being 95.0869, made by a syndicate composed of the Mercantile Trust and Deposit Co., Baker, Watts & Co., Hambleton & Co., and the Guaranty Trust Co. Poe & Davies bid on approximately $1,000,000 of the bonds with early maturities, 1924 to 1927, offering 95.58 to 97.34.

Oregon Lets Many Contracts

Contracts for over $500,000 of road and bridge work were let by the Oregon State Highway Commission on Feb. 1, including $427,098 for paving, $90,200 for bridges and $3,375 for guard fences.

Included in these contracts are 8.6 mi. of paving on the Pacific Highway between Monroe and Junction City; 6.3 mi. of the Pacific Highway between Walker and Divide; a bridge over Canyon Creek in Douglas County; a bridge over the South Umpqua River near Myrtle Creek; four wooden bridges on the John Day Highway.

On Feb. 2, the commission reconsidered action previously taken on the paving 6.2 mi. of the Pacific Highway on the Roseburg-Dillard section and awarded the contract to the Hassam Paving Co. for $175,864.

General Goethals Reports on Ohio Highway Work

Change in the organization of the Ohio State Highway Department is not as important at present as radical change in the existing method and policy, according to the report of General George W. Goethals to Governor Davis. The present policy, General Goethals points out, does not result in the completion of main highways and consequently Ohio is without a connected system of improved roads. He recommends changes in existing laws to make it possible for the state to construct and maintain a state system of roads, leaving to the counties the task of building county feeder roads. "The state then would secure a system of highways under its own control," continues Goethals, "constructed for the state as a whole, under an organization which could be held responsible for results."

Alabama $25,000,000 Bond Issue Unconstitutional

The Alabama Supreme Court on Feb. 3 declared unconstitutional the measure submitting to the voters of the state an amendment to the state constitution which permitted the issuance of $25,000,000 of road bonds. The amendment was passed last year by a referendum vote.

Road Work in Hennipin County, Minnesota

Hennepin County, Minnesota, spent $1,500,000 on highway improvement last season, according to F. E. Terrell, County Surveyor. Among the major projects of the county were the Lyndale Ave. Bridge, $505,000; Long Meadows Bridge, $106,229; paving Lyndale Ave., $200,996, and grading Cedar Ave., $123,000.

Labor on construction and maintenance of county roads and bridges cost $122,139. Machinery was purchased at a cost of $24,194, and included a pressure oil distributor, gravel screening plant, loading crane and 10-ton "Caterpillar" tractor.

Subgrades

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soil, and its bearing power under the different quantities of water; its analysis as to fineness and its classification.

These, along with many other characteristics of the soil, are being studied and determined.

The intricate classification of the soils and their behavior under heat, cold and moisture, seems to have a deterring effect and be very discouraging to many, but the complications and unknown quantities that will have to be met makes the work only that much more interesting. When the problem has once been solved, the speaker feels that the conclusions will be so thoroughly worked out that the subject will be solved for all time to come. With the experiments being carried on by the Bureau of Public Roads and by the different universites and laboratories of the country, we can feel assured that an improvement in subgrade conditions will be arrived at in the near future, and that it will not be many years before a really satisfactory solution will be found—one that can be used with economy, and with assurance that a road constructed in accordance therewith will support the load specified, and the bearing power of the subgrade no longer will be an unknown factor.

Not until these problems have been solved so that an inspector on the road can make a test of the subgrade material and determine its bearing power and the kind of surfacing that should be used will the problem be satisfactorily solved. The speaker looks

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New Hampshire Good Roads Association

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The bill before the New Hampshire Legislature to establish a state highway commission which would take over the authority now exercised by the state highway commissioner is due to run against genuine opposition, so supporters of the present one-man head system declare. Those who will oppose the bill introduced by Representative Charles B. Ross, of Lebanon, contend that the creation of a state highway commission would mix politics with the construction and maintenance of the state's highways, and that conditions will be no better than in the days of the administration of Governor Samuel D. Felker, when the present system was created because of the confusion which existed.

Though no apparent move has been made to interest members of the Legislature in the bill, which it is said was drawn by a Dartmouth college professor, one hears gossip to the effect that the intention of the proposed law is to put the highway department into the hands of three commissioners in order that there may be a reduction of the force of engineers and other skilled employees now employed by Highway Commissioner Frederick E. Everett.

It is said that the supporters of the bill will urge the committee on public improvements, of which Ovid F. Winslow of Nashua is chairman, to make a favorable report on the ground that a three-member commission can exercise better judgment in the designation of new routes for permanent highways than can a single commissioner. The text of the proposed law which would reorganize the highway department is as follows:

Section 1. The state highway department, as provided for in Section 1, Chapter 103, Laws of 1915, is hereby terminated, and there is hereby created a commission for the laying out, construction and maintenance of highways constructed and maintained in whole or in part by the use of state funds, which shall be known as the state highway commission.

Section 2. Within 30 days after the passage of the act, the governor, with the advice and consent of the council, shall appoint and commission said state highway commission which shall consist of three commissioners—one commissioner shall be an engineer, one a business man, and one a lawyer, all of whom shall be interested in the state highway problem. One member shall be appointed for two years, one member for four years, one member for six years and thereafter at intervals of two years one member for six years. Vacancies in said commizsion shall be filled by the governor and council for the unexpired term or terms.

Section 3. The members of the state highway commission shall be paid at the rate of $8 a day each, for such time as they are actually employed in the service of the state. They shall be allowed also their necessary, reasonable expenses while on official business.

Section 4. Said state highway commission shall have all the powers and perform all the duties imposed by the laws of the state in force next prior to the passage of this act upon the state highway commissioner and the governor and council so far as the same relate to highway matters. They are hereby authorized and empowered to appoint, epmloy, and fix compensation of a state engineer, agents and servants, furnish such equipment as they may consider necessary, and make such regulations as may be necessary to carry into effect the objects and provisions of this act. They shall be provided with suitable quarters in the state house for their office and that of their department and they may employ such expert and clerical assistance as in their opinion is necessary. They shall exercise general supervision, control and direction, on behalf of the state, over all matters pertaining to the location, construction, maintenance, and abandonment of highways, now or hereafter built of maintained either in whole or in part with money appropriated from the state treasury. They shall have the power to fix and decide upon the location and route of any highways now or hertafter authorized to be built, whether the same be wholly within one town, or between places adjacent or remote; the order in which work thereon shall be begun, prosecuted or completed; the method of construction to be employed; the kind and quality of material to be used; the manner in which any such highway shall be maintained; and all other matters pertinent thereto, including the awarding of all contracts for the construction or maintenance of such highways and supervision of the work done thereunder. They shall have the same powers heretofore delegated to the state highway commissioner and the governor and council in regard to the purchase of land or material necessary for the construction and maintenance of highways, as provided by Section 9, Chapter 35, Laws of 1905, and Section 4, Chapter 103, Laws of 1915, but the taking of land or material for such purpose by the exercise of the process of eminent domain, and the sale and conveyance of land included in any discontinued portion of a highway, shall remain with the governor and council, as provided in said section.

Section 5. Said state highway commission shall make a biennial report to the governor and council containing a statement of all work done and expenditures incurred by the commission, together with such other information as may be of public interest.

Section 6. The expenses of administration of this act shall be provided for as defined in Chapter 114, Laws of 1913.

Section 7. All acts or parts of acts inconsistent with this act are hereby repealed, and this act shall take effect upon its passage.

Representative Wallace Cole, of Hampton, has introduced a bill in the Legislature which calls for an appropriation of $15,000 to be expended for the erection of a breakwater along North Beach, at Hampton, where the ocean of late years, has badly washed away the state road. The encroachment of the sea has also threatened the destruction of considerable property.

The town of Hampton at the last town meeting appropriated a sum for repairs and other work on the various breakwaters at the beach, but the aid from the state, it is believed by local people, will be a benefit to all who use the road.

All office holders in the Manchester city government would be ousted under the provisions of a bill proposed by Rep. Frank H. Challis of Ward 4 at a meeting of the Manchester delegation held recently. The proposed bill would remove the mayor, aldermen, public works department and the directors of public works and they would be succeeded by five commissioners, who would be appointed by the governor, to serve until January, 1922, or until their successors were appointed.

The proposed bill is aimed directly at the present administration and indicates that the city would rid itself of the present offcals if the bill were adopted. The proviso that the governor appoint the commissioners for one year indicates that some other plan might be worked out before the end of the commissioners' term of office.

Fred L. English, former representative from Littleton, appeared recently before Governor Albert O. Brown and council to urge action in the matter of freeing the toll bridge across the Connecticut River between Waterford, Vt., and Littleton. The state of Vermont has agreed to appropriate its share of the amount needed to free the bridge.

Massachusetts Highway Association

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Announcement

This section of the paper is open to members of the Massachusetts Highway Association for the discussion of matters directly connected with road interests. Members are requested to submit items of interest for use in this column.

Address all communications to GOOD ROADS, P. O. Box 2705, Boston.

Among the plans suggested as being apropriate as a memorial of the World War is one for an "Avenue of Enduring Peace" to connect the Cambridge Bridge with the Fellsway at Broadway Park, Somerville.

Our splendid Metropolitan Park System is rent asunder. One-half of it lies to the south of Boston; one-half to the north of it. The southern sector is already served by several fine boulevards. The north is reached only through freight yards and demi-slums. In Somerville, at Prospect Park, the northern parkways really begin. From this point well into Cambridge an avenue has already been planned and estimates of its cost already figured. The figures are for about two-thirds of the now proposed route and cover the more expensive part. They total less than a third of the amount suggested by the Memorial Commission.

At the Boston end of the Cambridge Bridge ample land is available to make a dignified square while the elevated structure that carries the Cambridge trains from the Beacon Hill tunnel might well be subjected to artistic treatment that would lend impressiveness to the approach to the bridge.

Charles Street, widened and improved, makes an ideal outlet at this point to Park Square and the Parkway system to the south or Shoreside road of the Esplanade to Arlington St. and Commonwealth Ave.

As a mere highway proposition it was considered as a 60-ft. street. From Prospect Park to the Cambridge line at Columbia St., it was estimated $1,000,000 would cover the cost of both construction and damage. An 80-ft. roadway was estimated at $1,250,000 and a 100-ft. avenue, such as would be needed to make the avenue truly memorial, would probably not cost more than $1,500,000 on such a basis, as the damage to abuttors would practically be identical regardless of the width of the takings.

The principal commemorative features would be at the two terminals. Prospect Park offers a splendid site for an arch, while Kendall Square would probably be better served by a column. Elsewhere along the route smaller groups to commemorate individual battles or divisions might well find place and the local cities could well erect their special tributes to their quotas there.

The state has invested nearly $1,000,000 in the construction of the Mohawk Trail and a plan is now proposed that will protect the scenery bordering the road.

No one who has traveled over the trail needs to be told why its fame has gone so widely abroad. Those who have not yet had that experience have at least heard that as a road it is a joy to ride on. Now that the Public Works Department has found a way to rid that landscape of the disfiguring billboards the native beauty of the trail is all but secure. All but! The fact is that the mounain forests that clothe the precipitous walls of the gorge of Cold River and Manning Brook are not the property of the state. Until that road was built through their midst those trees were safe, for they were remote from market. In those days it was of no public consequence whether they were safe or not, for no one saw them except an occasional hunter. Thanks to the road, their market is now available, and there is a pressing demand for timber. Is it of any public consequence now whether those trees shall continue to grow upon those mountain sides or go to the mill? That is a question that the state, through its Legislature, must at once decide. To keep them where they are as an ornament to the trail will involve the expenditure of $65,000 of public money. On Feb. 9, the Committee on Conservation of the Legislature loaned an attentive ear to all who believed that this additional investment in a million dollar property is justified, and to those as well whose desire for economy in public outlay would lead them to object.

What is now contemplated under Commissioner Bazeley's bill is the establishment of a scenic reservation of approximately 4,500 acres, which will include all of the steep slopes to the skyline along the beautiful gorge at the eastern gateway to the mountain section of the trail. This is the identical section that the Forest Commission recommended in 1916 as desirable for a reservation such as is now proposed.

Feeling among New England Congressmen that their part of the country is taxed out of proportion to the benefits received was reflected by their vote on the Sells Bill, just passed by the House, to authorize an appropriation of $100,000,000 to be expended by the Federal Government in cooperation with the states in road building.

Although the bill would make more than $4,000,000 available for the New England states, in addition to about $4,500,000 which will represent a balance available Apr. 1, 1921, 25 of the 28 New England House members who voted on the measure voted against it, the exceptions being Congressmen White, Peters and Hersey of Maine, where agitation for more and better roads is strongly pushed by farmers' organizations and where federal aid is sought.

The test came on suspending the rules so the measure could be immediately passed. The following voted against the bill:

Treadway, Paige, Winslow, Rogers, Lufkin, Phelan, Dallinger, Tague, Tinkham, Gallivan, Luce, Olney, Greene and Walsh of Massachusetts; Freeman, Tilson, Merritt and Glynn of Connecticut; Burroughs and Wason of New Hampshire; Burdick, Stiness and Kennedy of Rhode Island; Green and Dale of Vermont; total 25.

The vote on the bill was 278 in favor and 58 opposed.

Congressmen Walsh and Treadway of Massachusetts spoke against the bill.

The following table shows how the New England roads stand with respect to federal road funds available and their apportionment under the Sells Bill:

States	Amount Federal aid available for contract Dec. 31, 1920	Federal aid under contract since Dec. 31, 1920
Connecticut	$864,901.70	None
Maine	1,160,686.57	None
Massachusetts	2,210,243.09	$121,416.20
New Hampshire	233,261.99	None
Rhode Island	191,085.13	100,000.00
Vermont	743,181.73	None

States	Federal aid which will be under contract by April 1, 1921	Amount Federal aid for new contracts April 1, 1921	at $20,000 a mile Mileage
Connecticut	None	$864,901.70	43
Maine	None	1,160,686.57	58
New Hampshire	$8,500.00	224,761.99	11
Massachusetts	156,360.00	1,932,466.79	96
Rhode Island	91,085.13	All contracted	None
Vermont	500,000.00	243,181.73	12

States	Date when all Federal aid funds will be absorbed by contracts	apportionment Federal aid under Sells Bill
Connecticut	July 1, 1922	$613,349.43
Maine	June 30, 1921	960,230.16
Massachusetts	Oct. 1, 1921	1,472,788.83
New Hampshire	Oct. 1, 1921	414,838.93
Rhode Island	Already absorbed	233,256.87
Vermont	Oct. 1, 1921	450,077.09

There is the usual activity on Beacon Hill in the matter of highway legislation.

There are numerous old friends among the bills that have been listed, such as measures to require every owner of a motor vehicle to provide a bond or an insurance policy to enable persons who may be injured in an accident to recover damages. Such legislation has been proposed annually, discussed by committees and by special commissions and has been regularly rejected. Headlights and muffler cutouts are the subjects of two or three bills, regardless of the fact that the state registrar of motor vehicles has ample power to deal with such matters. The old suggestion that the police departments of the state distribute number plates is up again. It seems even less necessary than previously, because this year the registrar is sending out the plates free of postage to applicants.

Another ancient bill that comes to life each year is that to have the fines assessed upon motorists returned to the towns instead of going into the state motor vehicle fund for road maintenance.

The motoring organizations, like the state association and various clubs that make it a part of their business to fight inimical legislation, are preparing

(Continued on page 120)

New York State Road Builders' Association

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Crusher Run

The New York State Road Builders' Association held its annual meeting on Jan. 26, 1921, at its rooms in the Journal Building, Albany, N. Y. The meeting was largely attended, and was followed by a banquet at the Hampton Hotel in the evening.

Commissioner Greene was one of the speakers at the dinner and in bidding good-bye to the members of the association, mentioned the fact that he had always tried to give them a fair deal. He said that he considered the road contractors an asset to the state, and that New York State had more good contractors than any other state in the Union. Out of the 200 or more conracts that he had let, he had not had one single dispute worth mentioning, and in all cases where the Department and contractors seemed to be equally right he always favored the man at the bat.

Commissioner Greene's successor, Herbert S. Sisson, was also a guest of the Association, and said that he intended to carry on the office in a manner that would be profitable to the state and to the men who did the actual work.

John H. Gordon, President of the New York State Road Builders' Association, acted as toastmaster at the dinner. The other speakers were S. D. Gilbert, the retiring auditor of the Department, Roy Hall, who spoke for the engineers; William Acheson, who spoke for the Division Engineers; A. J. Rockwood, of Rochester, and Richard Hopkins, of Troy, who spoke for the contractors; and Judge James A. Parson.

Among the guests were Senator Charles J. Hewitt of Cayuga, Fred E. Ellis, Melrose, Mass., Benjamin P. Wheat, Saratoga Springs, Attorney General Charles Newton, C. J. Hendrickson, Syracuse, Senator Warren T. Thayer, Chateaugay, Irving V. A. Huie, of the State Highway Department; C. R. Cornell, Superintendent of Highways, Dutchess County, Frederick W. Sarr and Paul Schultze.

All the members of the Association were in attendance, as were representatives of the associate members. All contractors of record to whom invitations had been extended were also present in large numbers.

Herbert S. Sisson, formerly state excise commissioner, has succeeded Frederick Stuart Greene as state commissioner of highways.

Employees of the State Highway Department presented to retiring Commissioner Greene a jeweled gold watch. The presentation was made by Auditor S. D. Gilbert.

At a farewell address to county superintendents of highways, retiring State Commissioner of Highways, Frederick Stuart Greene, defended his concrete roads. During his two years as highway commissioner his policy has been the building of only durable roads, and a policy which he thought was for the best interests of the state and the taxpayers.

S. D. Gilbert, retiring auditor of the State Highway Department, was given a dinner at the Hampton Hotel by members of the department. Commissioner Greene acted as toastmaster. The speakers were Maj. Irving V. A. Huie, Secretary of the Department, Wm. H. Sherritt, Chief Clerk of the State Comptroller's office, and Louis L. Gowdy. Mr. Gilbert was presented with a diamond scarf pin. The presentation was made by Joseph Sheary.

Bids were received for 20 contracts on Jan. 26, and the awards in 14 cases were made by Commissioner Sisson on Feb. 4. This was in keeping with Governor Miller's order to former Highway Commissioner Greene. The other contracts were held pending some minor inquiries and qualifications by the contractors.

Previous to the letting which took place on Wednesday, Jan. 26, 1921, Commissioner Greene notified about 200 contractors who had bid on contracts that Governor Miller had requested him not to make any awards, so that the new commissioner, Herbert S. Sisson, would have an opportunity to pass upon matters with relation to the policy he might decide to adopt.

In the test case which is being tried in the Court of Claims for relief of contractors, under the Knight Bill, Judges Ackerson and Morschauser hold that the

Legislature cannot pass laws which virtually audit and provide for payment of private claims. Judge Smith disagrees with both judges on the constitutional questions, holding that the Legislature acted entirely within its powers in granting the relief provided in the Knight Bill.

Mr. Charles Andros, senior assistant in the State Highway Department for the past twelve years, has resigned and will take a position in the United States Patent Office at Washington, D. C.

Mr. Charles Van Ambergh, of Binghamton, who has resigned as third deputy commissioner of the State Highway Department, was presented with a gold watch and Masonic charm by his office force.

Frederick Stuart Greene, former State Highway Commissioner, has sailed for Panama for a vacation trip. Upon his return he will take up his duties as president and general manager of the Waterproofing Co., New York, N. Y.

The Hewitt Highway Bill will benefit Warren County roads. Under it the state will pay 65% of the cost of construction and the county the balance. The bill provides for rebuillding of 5 mi. of the Ridge Road, from Glens Falls to the hamlet of Oneida. The other Warren County roads are the North Creek-North River Road and a part of the Hague-Ticonderoga Highway.

One of the first official acts of Herbert S. Sisson as state highway commissioner, was the appointment of Frederick W. Sarr as first deputy. Mr. Sarr was second deputy in Edwin Duffey's administration.

H. G. Hotchkiss has been appointed second deputy by Highway Commissioner Sisson. Mr. Hotchkiss is from Lyons, Wayne County, and has been an assistant engineer in the Rochester Division of the Highway Department for the past several years. He succeeds Captain Arthur Bradt. The salary is $5,000 a year.

J. C. Finch, of Albany, N. Y., has been appointed supervising engineer and assistant to the First Deputy Fred. W. Sarr.

Charles V. Platt, of Port Jefferson, Suffolk County, has been named by Commissioner Sisson to succeed S. D. Gilbert as auditor of the State Highway Department.

The bid for building the Middleburg-Franklinton Road, Schoharie County, has been rejected by Commissioner Sisson. The reason given was because the road is not on the Hewitt map. The bid was made by J. C. Connors Co., Inc., Schenectady, N. Y., at the letting which took place on Jan. 26, 1921.

Commissioner Sisson has appointed G. Alfred Haynes, of Jamestown, N. Y., as his private secretary at a salary of $2,500 a year.

Commissioner Sisson expects a big year in road construction. At the recent letting there were 79 bids on 20 contracts and every bid was within the engineer's estimate.

One of the largest road construction jobs in the history of the state was awarded to the Rosoff Engineering Co., of New York City. The contract is for constructing the Andes-Margaretville Road in Delaware County, a 10-mi. stretch of highway. The amount of the contract is $525,501.10.

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Massachusetts Highway Association Notes

(Continued from page 118)

for their usual work and they have practically decided to stand pat against any changes in the law, though they may find it desirable to support some bills when they come up for hearing. There is now in Massachusetts one motor vehicle for practically every other family, and with such strength the motorists do not believe that the Legislature will pass any very drastic new laws or further encumber the statute books with laws that will not be obeyed or enforced, because they are unnecessary or unworkable.

A change is suggested in the right of way law, so that vehicles on main thoroughfares will have the right of way over vehicles on side streets. This is regarded by many as a more logical arrangement than the present law, giving the right of way to the vehicle coming from the right regardless of the status of the road. But the main thoroughfare idea has been thoroughly investigated in the past, and it was believed that such a rule would not work out satisfactorily, owing to the difficulty of designating main roads.

Because accidents happen when windshields are clouded by rain or snow, one petitioner for legislation would require that every car be equipped with a windshield cleaner. Another bill proposes a law to require that registration plates shall be made more visible at night, a matter that is under the control of the registrar, just as are the headlight and muffler rules. A bill has been entered to require that transfers in the ownership of motor vehicles shall be recorded within fourteen days of the transfer with the registrar. This matter is now very well taken care of under the used car law, which is working out in a very satisfactory manner.

An entirely new suggestion for this state has been put forward in a bill to require an annual examination of all motor vehicles by the police, in order to see that the vehicles are in condition to be used with safety to the public. Following the examination, if the vehicle were found to be in satisfactory condition, the owner would be given a certificate to be pasted on the windshield and kept there until the next annual examination.

With the policy of the state directly opposed to creating any more commissions, the bill to establish a Good Roads Commission will get short shrift. It is the desire of the petitioner for this legislation to have a commission of five members to be paid $5,000 a year each, which will take over the work of the highway division of the Department of Public Works and build roads with prisoners for labor. It is planned to give the commission $5,000,000 with which to build concrete roads, the money to be raised by a bond issue. This would be virtually reverting to the old highway commission, with the added responsibility of doing its work with prison and institutional labor, a plan that in various sections of the country has proved beneficial to the prisoners but expensive and not very satisfactory to the state.

About the only bill that has been put in by the motor vehicle interests is that of the Massachusetts State Automobile Association to require owners of horse-drawn vehicles to register them and pay fees. This measure was put in as a sort of back-fire to the proposal to increase motor vehicles fees and with little thought that it would make much progress. It has, however, met with a remarkable amount of favor among those who believe that everybody using the highways should help maintain them.

The big fight is coming on the proposal of the registrar of motor vehicles materially to increase the registration fees on cars and trucks. This suggestion has met with widespread opposition, which is becoming consolidated into a determination to oppose without compromise any change in the fees law. Motorists feel that the nearly $4,000,000 that they paid to the state in fees and fines last year is sufficiently large contribution and in an era of falling prices they cannot see any justice or reason in a proposal to increase fees 50 to 100%.

The argument has been made that the fees should be increased because it has cost so much more to maintain the highways. As a matter of fact, the high cost of road building reached the turning point some months ago, and with more unemployment about the state, contractors anticipate no difficulty in securing all the labor they want in the spring at reasonable prices. The cost of road materials also is trending downward.

The motoring organizations have taken up this increased fee matter seriously and they intend to present a solid front in opposition when the matter comes up for hearing. They also are at work among the legislators and are preparing data to be presented to show that an increase at this time would be unfair and a burden upon transportation. The truck men and the passenger car men have united in this fight and owners of small cars will be found lined up with owners of large vehicles, for all are affected.

The Massachusetts Highway Association and the New England Road Builders' Association might well take some active interest in preventing the passage of some of the above objectionable measures.

Subgrades

(Concluded from page 115)

forward to the time when some simple test will determine the bearing power of the soil, and an inspector can look on his blueprints and tell the type and character of surfacing that should be used on that particular kind of soil; or he will be able to turn to his specifications and see the treatment necessary to bring the soil up to a certain bearing power. He will then immediately know how to proceed with the construction of the road in order that it may have a uniform strength throughout its entre length at all seasons of the year and be capable of carrying a specified load without danger of destruction.

If the engineering skill and ability of this country can be directed to this great problem, the speaker has no fear but that it will be solved, and properly so. It is with this idea in view that he is attempting in this talk to arouse his brother engineers to a sense of their responsibility. There are no engineering problems that have affected the welfare of the people of this country and the world materially that have not been solved by the engineers most satisfactorily when once presented to them, and the speaker feels that if the engineers of the country will make a study of this problem and find how it affects the life and cost of the highways, they will devote a great deal more time and thought to its solution. When this is done, there is no question but that some solution will be found very speedily, and that the road building of the country will be put on a scientific basis rather than on a hit-or-miss plan. He trusts that he has outlined in this article, in a brief way, a few ideas that will bring to the minds of those interested the necessity for proceeding with this investigation and finding a reasonable solution at once.

The Subgrade Committee of the Federal Highway Council is anxious to cooperate with the state highway departments and all the leading laboratories and universities throughout the country in an effort to throw as much light on this subject as possible, and it asks your cooperation in collectng all the data that can be secured, looking to that end.

MEETINGS

Calendar of Coming Meetings

Feb. 21-23—Minnesota Surveyors' and Engineers' Society.—Annual convention, Hotel Commodore, St. Paul, Minn. Secretary, C. H. Stewart, 811 Guardian Life Bldg., St. Paul, Minn.

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 23-26—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

Short Highway Engineering Course at University of Illinois

The University of Illinois, in cooperation with the Illinois State Highway Department, will hold a short course in highway engineering at the university at Urbana from Feb. 21 to 26. It is expected that a large number of state and county officials will be in attendance.

Concrete Mixer Association

At the annual meeting of the Concrete Mixer Association recently held in Chicago, Ill., the following officers were elected: President, Clifford F. Messinger, General Sales Manager, Chain Belt Co.; Vice President, W. B. Knickerbocker, Knickerbocker Co.; Treasurer, A. T. Scannell, Archer Iron Works. H. E. Smith, of the T. L. Smith Co., was elected chairman of the Executive Committee.

Nevada Highway Association

At a recent meeting of the Nevada Highway Assocation, four committees were appointed as follows: Legislation: William Woodburn, A. S. Henderson, George A. Montrose; Motor Vehicle Laws: George W. Harrison, Ernest Bishop and George Hunting; Gasoline: W. H. Goodin, E. W. Griffith, L. G. Ginnochio, J. H. Causten and A. W. Hesson; Automobile Thefts: J. C. Durham, R. M. Price and Ray McIntosh.

Colorado Society of Engineers

The Colorado Society of Engineers held its annual meeting on Jan. 19 and the following addresses were presented: "Engineer's Problem of the West," by Fred J. Lucas; "Transportation," by John Crook, and "Engineers' License Law," by Senator Walter O'Brien. Officers were elected as follows: President, F. C. Dreher; Vice President, R. M. Hoesa; Secretary, C. M. Lightburn.

PERSONAL MENTION

Jerry Donohue has been appointed city engineer of Hartford, Wis.

W. S. Henderson has been appointed city engineer of Lawrence, Kan.

Alfred Bond has resigned as road supervisor of Albany Township, Pa.

G. A. Russell has been appointed engineer of Pottawatomie County, Kansas.

A. J. Johnson has been appointed a member of the Florida State Road Department.

C. D. McPherson has been appointed minister of public works of Manitoba, Canada.

Thomas R. Gilmore has been appointed road superintendent of Clinton, Ontario, Canada.

T. W. Lawlor has been appointed superintendent of public works of Poughkeepsie, N. Y.

L. A. Du Fresne has been appointed highway engineer of Calhoun County, Mississippi.

W. S. Gibson has resigned his position with the Ontario Department of Highways, Canada.

Andrew Lenderink has resigned as city engineer of Kalamazoo, Mich., to enter private practice.

Elbert Reynolds has been appointed a division engineer of the Arkansas State Highway Department.

John H. Neeson has been appointed deputy chief of the Street Cleaning Department of Philadelphia, Pa., at a salary of $6,000 per year.

S. F. Hanning has been appointed resident engineer at St. Thomas by the Ontario Department of Highways, Canada, succeeding W. S. Gibson.

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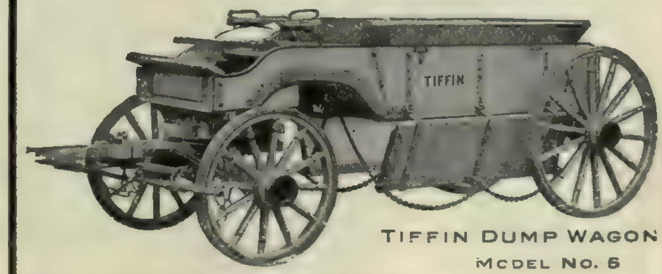

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Old Series, Vol. LX
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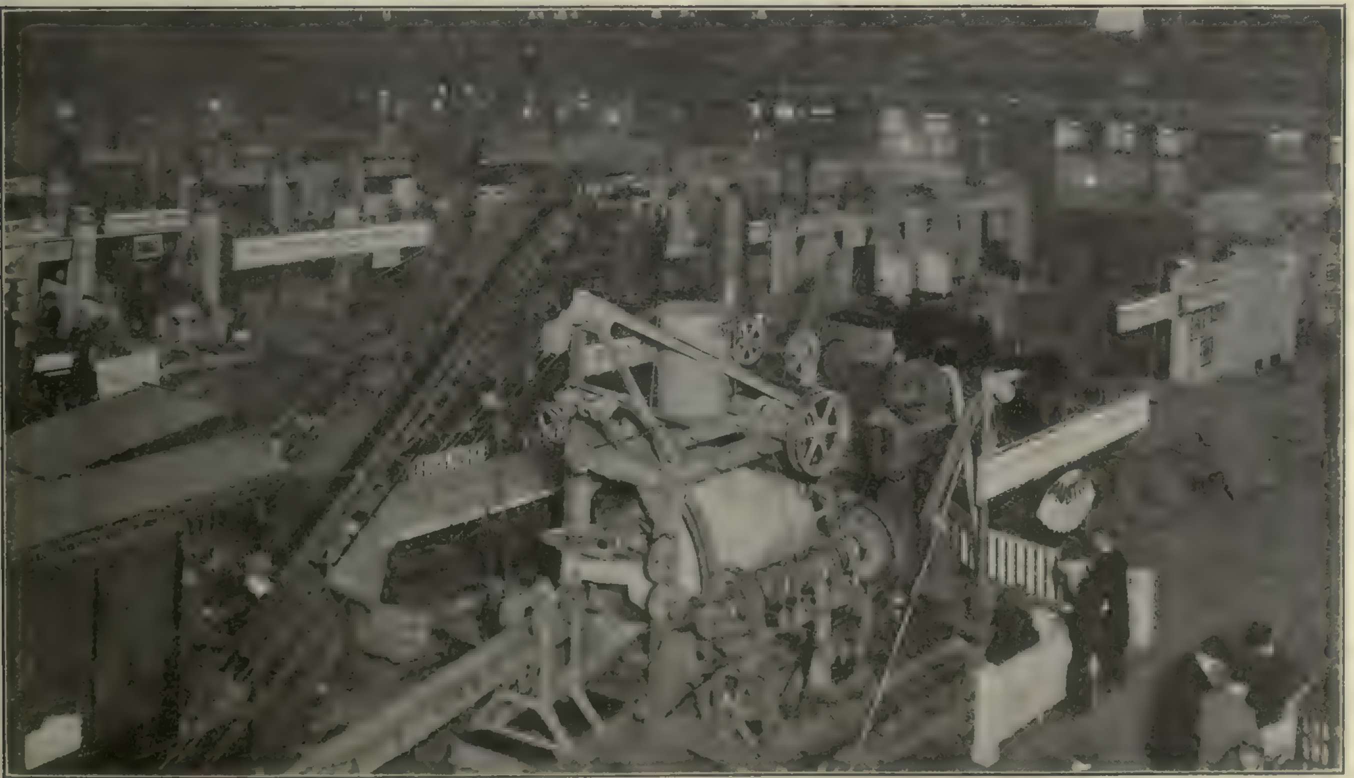
JAMESTOWN, N. Y., MARCH 2, 1921

Number 9

The Twelfth National Good Roads Show Under the Auspices of the A. R. B. A.

The Twelfth National Good Roads Show was held in connection with the Eighteenth Annual Convention of the American Road Builders' Association at the Coliseum, Chicago, Ill., on Wednesday, Thursday, Friday and Saturday, Feb. 9, 10, 11 and 12. In all respects it was the largest and most successful exhibition of machinery and materials used in the construction and maintenance of roads and streets ever gotten together. The Coliseum and Annex were filled and thousands of delegates and guests thronged the building from the opening of the doors until the exhibitors began moving out their display late Saturday afternoon.

There were 129 separate exhibits. Of this total, 116 were manufacturers of road and street machinery and materials, dealers in equipment and material, motor truck and tractor manufacturers, manufacturers of engineering instruments, and paving companies. The remaining 13 comprised 9 publications, 2 associations and 2 government units. The last two were the Board of Local Improvements of the City of Chicago and the Bureau of Public Roads of the U. S. Department of Agriculture. The Bureau of Public Roads, besides maintaining a display of testing apparatus and a demonstration of testing methods in its space in the Coliseum, held a demon-



GENERAL VIEW OF GROUP OF EXHIBITS AT THE TWELFTH NATIONAL GOOD ROADS SHOW OF THE A. R. B. A. AT THE COLISEUM, CHICAGO, ILL.

stration of the methods of testing the impact of trucks upon road surfaces in a paved alley in the rear of the building.

Many of the commercial exhibits included heavy machinery, much of which was operated by electric motors installed for the purpose. A fairly close estimate placed the value of the machinery and equipment displayed at close to a half million dollars.

In the following paragraphs are given, in the order noted, the name of the exhibitor, the address, a brief description of the exhibit, and the name of the representative or representatives in attendance.

American Steel & Wire Co., Chicago, Ill. Display signs; concrete reinforcement fabric. B. S. Pease.

Adams & Co., J. D. Indianapolis, Ind. Model of "Road King" grader and moving pictures.

American Association of Engineers, Chicago, Ill. Literature. E. B. Miller.

"American City, The," New York, N. Y. Copies of "The American City" and the "Contractors' and Engineers' Purchasing Guide." Edgar J. Buttenheim.

American Road Plane Co., Chicago, Ill. Road plane. J. W. Lee.

Asphalt Association, The, New York, N. Y. Asphalt road models, impact test exhibit, photographs, charts, publications. J. E. Pennybacker, W. E. Rosengarten, J. B. Hittell, Bruce Aldrich.

Asphalt Block Pavement Co., Toledo, Ohio. Asphalt paving blocks. E. J. Snyder, G. A. Lowry.

Asphalt Pavement Retreading Co., Chicago, Ill. Asphalt pavement retreader.

Austin Machinery Corp., Chicago, Ill. Austin cube mixers, Austin cube pavers, Austin gasoline locomotives, Austin batch cars, Austin backfillers, Austin shovels, Austin self feeding loaders. W. Z. Carter and H. A. Hooker.

Austin-Western Road Machinery Co., The, Chicago, Ill. Motor road rollers, motor tandem rollers, Aurora rock crusher, combination scarifier grader, Western tractor grader, motor pickup sweeper. S. F. Beatty.

Autocar Co., The, Ardmore, Pa. Two 2-ton F. chasses, with bodies for road material.

Ball Engine Co., Erie, Pa. Photographs and literature. J. A. Garber and H. J. Tobin.

Barber Asphalt Paving Co., The, Philadelphia, Pa. Native lake asphalts, samples and pavement samples; literature on Iroquois road rollers, asphalt mixing plants, etc. J. E. Morris, R. G. McKay, E. D. Lockwood, E. C. Wood, T. E. Brady, J. A. McDonald, J. E. LeStarge, H. T. Macfarland, G. R. March.

Barber-Greene Co., Aurora, Ill. One Barber-Greene loader, moving pictures, model, miscellaneous parts. C. H. Nickell.

Barrett Co., The, New York, N. Y. Changing slides, literature, auto tank truck model. B. M. Smith.

Barrett Cravens Co., Chicago, Ill. Gasoline tractor, lift truck. L. W. Noble.

Beach Mfg. Co., Charlotte, Mich. Gravel screening machinery, tamper rollers, graders, road drags, culverts, etc. F. H. Beach, J. Sanders.

Bitoslag Paving Co., New York, N. Y. Photographs and samples. Joseph R. Draney.

Black & Decker Mfg. Co., Baltimore, Md. Portable electric drills and loadometers. W. R. Greer, G. W. Brogan.

Boureau & Co., H. U., Philadelphia, Pa. Three angle paving guards. R. C. Walker.

Browning, Victor R., Cleveland, Ohio. Photographs. Victor R. Browning.

Burch Plow Works Co., Crestline, Ohio. Burch stone unloader, Burch coal unloader, Burch stone spreader, Burch cast iron pipe. B. H. Ferguson.

Byers Machine Co., Ravenna, Ohio. Byers cranes, photos of installations. L. A. Babcock.

Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. "Economy" reversible manhole curb. A. M. Thompson.

Carbic Mfg. Co., Duluth, Minn. Acetylene lights and generators. A. D. Guthrie.

Carey Co., The Phillip, Lockland, Cincinnati, Ohio. Samples, literature, souvenirs. H. R. Koester, F. C. Smith, J. J. Milar.

"Cement & Engineering News," Chicago, Ill. Copies of publication. R. J. Bowers.

Chalmers & Williams, Chicago Heights, Ill. Literature.

C. H. & E. Mfg. Co., Milwaukee, Wis. Power-driven triplex pump, power bilge.

Chicago, City of, Board of Local Improvements, Chicago, Ill. Drawings and photographs of Chicago street improvements. Clarence W. Farrier, Joseph M. Bush.

Clark Truckractor Co., Buchanan, Mich. Clark tructractors. L. J. Schneider, W. B. Eldred, G. M. Chase, J. W. Taylor.

Cleveland Tractor Co., Cleveland, Ohio. Tractor. W. E. Blaine.

Clydesdale Motor Truck Co., Clyde, Ohio. Five-ton Clydesdale chassis.

Columbian Steel Tank Co., Kansas City, Mo. Dump body and hoist. G. F. Price.

Conneaut Shovel Co., Conneaut, Ohio. Shovels. E. D. Moore.

Conway Co., R. F., Chicago, Ill. Brick filler and asphalt paints. Wm. Damewood.

Cressy Road Sprayer Mfg. Co., Everett, Mass. One Cressy-Pillsbury sprayer on a 5-ton Mack truck. Eva Cressy and R. Pebworth.

Cummer & Sons Co., The F. D., Cleveland, Ohio. Catalogues, etc. I. Preeman.

Custer Battlefield Highway Ass'n., Sheridan, Wyo. Photographs, literature, maps, etc. White Eagle.

Davenport Locomotive Works, Davenport, Ia. Davenport gear drive locomotive. W. Chadwick.

Dietzgen Co., Eugene, Chicago, Ill. Surveying and drawing instruments. Guy C. Moore.

Domestic Engine & Pump Co., Shippensburg, Pa. Pumping and hoisting engines. W. E. Barbour, C. B. Segner, P. M. Kidd.

Dunn Engineering Co., Chicago, Ill. One 3½-ton Titan truck. Robert A. Dunn.

Dunn-Wire Cut Lug Brick Co., Conneaut, Ohio. Types of paving brick. Frank B. Dunn, J. C. Travilla.

Earth Concrete Co., Grand Rapids, Mich. "Earthcrete." Alvah Brown, R. S. Greenwood.

Galion Iron Works & Mfg. Co., Galion, Ohio. Moving pictures. J. S. Boyd, J. M. Patterson, J. M. Laudenberger.

Garford Motor Truck Co., Lima, Ohio. Two-ton dump body, special contractors' short wheel base dump job. ..

General Motors Truck Co., Pontiac, Mich. G. M. C. road builder truck, 2-ton special hydraulic dump.

"Good Roads," New York, N. Y. Copies of publication. M. D. Powers.

Granite Paving Block Manufacturers' Association of the U. S., Boston, Mass. Literature. J. J. Tobin.

Green, L. P., Chicago, Ill. Arrow power drag scraper. L. P. Green.

Hercules Powder Company

Austin Machinery Corporation

TYPICAL EXHIBITS AT THE TWELFTH NATIONAL GOOD ROADS SHOW

East Iron & Machine Co., The, Lima, Ohio. Merriman 1-car steam melting asphalt plant. C. C. Mosher, A. J. Filliez, G. Merriman.

Easton Car & Construction Co., Easton, Pa. "Superservice" batch car and batch box. C. J. Derrick, Charles Tyler, H. H. Siff.

Elgin Sales Corp., Chicago, Ill. Motion pictures. George C. Dodge.

Engineering & Contracting Pub. Co., Chicago, Ill. Copies of "Engineering and Contracting." L. S. Louer.

"Engineering New-Record," New York, N. Y. Copies of publication. F. G. Hudson. J. P. Newman, M. B. Shropshire, M. J. McCullough.

Equipment Corp. of America, Chicago, Ill. Mixer, hoist, pump, swinger.

Fate-Root-Heath Co., Chicago, Ill. One 6-ton Plymouth gasoline locomotive. Roland S. Fend.

Federal Motor Truck Co., Detroit, Mich. Motor truck.

Foote Concrete Machinery Co., Chicago, Ill. Multifoote road paver.

Gurley, W. & L. E., Troy, N. Y. Engineering and drawing instruments. C. H. Smart.

Hadfield-Penfield Steel Co., Bucyrus, Ohio. Industrial gasoline locomotives. George G. Stein, J. A. Easton.

Hartnett-Stewart Motor Co., Chicago, Ill. Five-ton Atterbury truck with dump body. John M. Hartnett, J. W. Stewart.

Hastings Pavement Co., The, New York, N. Y. Asphalt paving blocks. P. L. Thompson, Thomas J. McNally.

Headley Good Roads Co., Philadelphia, Pa. Cold patching compounds. E. J. Hunt, M. H. Weeks, W. T. Headley.

Heil Co., The, Milwaukee, Wis. "Hydro" hoists, steel dump bodies. J. P. Heil, H. A. Winton, H. F. Kneppreth.

Heltzel Steel Form & Iron Co., The, Warren, Ohio. Steel forms. W. J. Savage, J. N. Heltzel.

Hendrickson Motor Truck Co., Chicago, Ill. Five-ton truck and dump body.

Hercules-Ajax-on Road Building Co., Chicago, Ill.

Model of road building appliance and model concrete blocks. George W. Jackson.

Hercules Powder Co., Wilmington, Del. Photographs and literature. N. S. Greensfelder.

"Highway Engineer & Contractor," Chicago, Ill. Copies of "Highway Engineer & Contractor" and "Road Maker, Excavator & Grader." E. W. Hinckley.

Highway Trailer Co., Edgerton, Wis. One drop-frame, reversible 4-wheel trailer with 2-way dump body; 1 heavy duty tractor reversible slow speed trailer with bottom dump body; 1 reversible 4-wheel trailer with bottom dump body; 1 gravity dump body for truck or trailer. J. W. Menhall, E. L. Moorman.

Holt Mfg. Co., Peoria, Ill. One 10-ton "Caterpillar" tractor; one 5-ton "Caterpillar" tractor equipped with snow plow attachment; literature; motion pictures. Louis A. Wilson.

Hvass & Co., Inc., Charles, New York, N. Y. Road building and street cleaning machinery. B. C. Hvass.

Hyland Co., R. H., Chicago, Ill. One ¾-yd. clamshell bucket; 1 Insley paving car with batch box; 1 No. 1 McKiernan Terry hammer, 1 Insley steel tower model; jacks, metallic hose, shovels, etc. A. J. Burghart.

Indiana Truck Corp. of Illinois, Chicago, Ill. Indiana dump truck, display motor, display transmission, display worm and gear. W. C. McKinney.

International Motor Co., New York, N. Y. Motor truck, dumper, oiler, flusher. D. C. Fenner.

Jeffrey Mfg. Co., Columbus, Ohio. Jeffrey radial loader. C. R. Heller, R. P. Jackson, E. L. Parsons.

J. T. Tractor Co., The, Cleveland, Ohio. J. T. tractor, Good Roads snow plow, projectoscope, pictures. J. B. Hoge, Theo. J. H. Wiegand.

Judy Mfg. Co., Centerville, Ia. One 7S power loading concrete mixer, 1 4S batch concrete mixer. L. P. Landman.

Keuffel & Esser Co., Hoboken, N. J. Engineering supplies. H. I. Rogers.

Kilbourne & Jacobs Mfg. Co., The, Columbus, Ohio. One LP-1 hoist, 1 KD 67 body, 1 HP-2 hoist. L. G. Miller and E. N. Hart.

Kinney Mfg. Co., Boston, Mass. Asphalt distributor and road oiler, road plane, asphalt pump. A J. Munday.

Kissel Motor Car Co., Hartford, Wis. One 2½-ton truck with dual hopper bodies, 2 heavy duty 4-ton trucks with dump body and hoist. Arthur W. Carndduff.

Klauer Mfg. Co., Dubuque, Ia. Culverts, flumes and road drags. R. W. Simpson.

Koppel Industrial Car & Equipment Co., Chicago, Ill. Two road cars, 1 batch box, 1 track section. A. Prausnitz.

Lakewood Engineering Co., The, Cleveland, Ohio. Photographs. Robert M. Jones.

Le Roi Co., Milwaukee, Wis. One power unit, 15 hp. C. W. Pendock.

Littleford Bros., Cincinnati, Ohio. Anderson road repair outfit.

Louer Co., W. B., Chicago, Ill. Construction equipment.

McCallum Corp., Angus, Detroit, Mich. McCallum improved road plane. R. A. Shappell and Angus McCallum.

"Manufacturers' Record," Baltimore, Md. Copies of publication and literature. Frank Gould, John Glass, A. C. Boughton, Jr., A. C. Boughton, Wm. H. Stone.

Marion Steam Shovel Co., The, Marion, Ohio Model steam shovel. Harvey T. Gracely.

Morand Cushion Wheel Co., Chicago, Ill. Literature. M. E. Whalen.

"Municipal & County Engineering," Chicago, Ill. Copies of publication. Victor E. Dolan, S. C. Hadden.

Nash Motor Co., The, Kenosha, Wis. Nash 2-ton truck with hydro hoist and all steel dump body.

National Steel Fabric Co., Pittsburgh, Pa. National street road fabric, National curb reinforcement. Chas. B. Dugan, Harry D. Beaton.

Nelsen Concrete Culvert Co., Pontiac, Ill. Reinforced concrete culverts. L. W. Nelsen.

Northwest Engineering Works, Green Bay, Wis. One 10-ton crawler crane, clamshell or drag line bucket handling. R. C. Forbes.

Overland Crane Co., Hammond, Ind. Locomotive crane. P. E. Cook.

Pan American Bridge & Construction Co., Chicago, Ill. Model of bridge. J. W. Lee.

Pioneer Tractor Mfg. Co., Winona, Minn. Tractor shovel. R. W. Johnson.

Portable Machinery Co., Inc., Passaic, N. J. Photographs. O. H. Carpentier.

Portland Cement Association, Chicago, Ill. Samples, photographs, literature, moving pictures. C. R. Ege.

"Public Works," New York, N. Y. Copies of publication. S. W. Hume.

Russell Grader Mfg. Co., Cicero, Ill. One motor "Hi Way" patrol. O. F. Barnett.

Sandow Motor Truck Co., Chicago, Ill. One 3½-ton chassis, one 2½-ton chassis.

Sauerman Bros., Chicago, Ill. Models of Sauerman dragline cableway excavators and Sauerman power scrapers.

Standard Oil Co. of Ind., Chicago, Ill. Road material.

Standard Scale & Supply Co., Chicago, Ill. Novo engines and outfits. Lloyd B. Kent.

Sterling Motor Truck Co., Milwaukee, Wis. One 7½-ton chain-driven dump truck.

Texas Co., The, Asphalt Sales Dept., New York, N. Y. Texaco asphalt.

Thew Shovel Co., The, Lorain, Ohio. Photographs

(Concluded on page 134)

Road Building in Alaska*

By COL. JAMES G. STEESE†

I am here today in a dual capacity: First as a representative of the War Department and in charge of its civil activities in Alaska, and second, as the official delegate appointed by the Governor of Alaska to represent the territory. My being in uniform has no relation to my actual duties but is one of the many anomalous situations arisng from the fact that our country is still technically at war. When we finally get down to a peace basis the Army will cease to be the main care of the War Department and the latter will resume its normal peace time role as a great civil branch of the Federal Government. Of the multitudinous civil functions of the War Department the most important are the river and harbor and related public works committed to the supervision of the Corps of Engineers.

In Alaska we are charged with river and harbor improvements, establishment of harbor lines, permits for docks, bridges, fish traps and other structures on our navigable waters, construction and repair of lighthouses and other aids to navigation, and construction, repair and maintenance of military and post roads, bridges and trails. The Government Railroad is under the Interior Department and is being built and operated by an army officer loaned to the Interior Department for that purpose.

Road Building Agencies

The Alaska Road Commission was organized in 1905 and is thus the oldest federal road buildng bureau. It is now responsible for the maintenance and extension of a system of road and trails aggregating almost 5,000 mi. Two years ago the Territorial Legislature passed a cooperative road act and appropriated $400,000 for two years, thus immediately releasing an accumulation of Forestry Funds under the Good Roads Act. During the first year the Alaska Road Commission acted as a Bureau of Public Roads Agency and supervised the expenditure of about $250,000 of Forestry funds. In addition, it expended a War Department appropriation of $100,000 from the Territorial Legislature, or a total of a little over $600,000.

This year, under an informal agreement among the bureaus concerned, the Bureau of Public Roads with Forestry funds and territorial money has assumed responsibility for most of the projects within the Tongass and Chugach Forest Reserves—about 100 mi. all told. The Alaska Road Commission retains its responsibility for the main military and post system of about 5,000 mi. and also expends about 40% of the territory's money on feeder lines where it is better equipped to handle such work. The Territorial Board expends the small balance of its funds on minor projects of purely local importance. For this year, therefore, the Alaska Road Commission had available under its own control a War Department appropriation of $350,000, an "Alaska Fund" of about $250,000 and about $85,000 of territorial money and other small contributed funds, or in all about $700,000. The "Alaska Fund" arises from federal trade and vocational license taxes outside of incorporated towns in the territory and by law 65% of it must be spent on roads, bridges and trails under the supervision of the Alaska Road Commission.

Though under the nominal supervision of the Chief of Engineers, the Alaska Road Commission is in the law and in fact an independent bureau occupying the same status as the Panama Canal, the Interstate Commerce Commission, the U. S. Railroad Administration, etc. My aproval of allotments, profits, funds and expenditures is final.

For next year we have estimated for a federal appropriation of $955,000 in addition to our "'Alaska Fund" which will produce about $125,000. The Territorial Legislature meets next month and is expected to apropriate $200,000 per year for the next two years. The Department of Agriculture will have available about $150,000, limited in its application to the Forest Reserves. If the $100,000,000 post roads bill passed last Monday in the House of Representatives should finally become a law in such form as to be applicable to Alaska, an additional fund of $375,000 per year would become available, or, in all, over one and three-quarter millions for Alaskan roads for next year.

Area and Topography

Alaska has an area of over 590,000 sq. mi. It is, therefore, more than twelve times the size of the State of New York, or practically one-fifth the size of the entire United States. Were the map of Alaska to be super-posed upon that of the United States, the tip of the southeastern panhandle would rest upon Charleston, S. C.; the extreme tip of the Aleutian chain upon Los Angeles, California; the North Polar shore would coincide with Duluth, Minn., and the open-all-the-year-round South Coast ports would be scattered through Northern Texas. Its coast line is 25% longer than that of the United States proper. The main body of the territory is about 800 miles square.

Though Alaska is often loosely referred to as an Arctic province, nearly three-quarters of its area is within the north temperate zone. The climate of the coastal section is comparable with that of Scotland, but somewhat warmer. That of the inland region is not unlike the climate of Alberta and Manitoba in Canada. The northerly section, bordering the Polar Sea, is the only one in which Arctic conditions prevail. In Fairbanks (latitude 65 degrees same as northern Norway), in the summer time the same clothing is worn as in New York City.

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*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Corps of Engineers, U. S. Army; President, Alaska Road Commission.

There is little level area in Alaska, expect the moss covered tundra of the far north and northwest. The coastal region as far west as Cook Inlet is wet, extremely rugged, and covered with a dense growth of medium-sized timber, especially on the seaward slopes. The valleys of the interior or central portions are fairly well timbered near the streams; elsewhere they are covered with a thick growth of underbrush, and the ground is overlaid with a blanket of moss, beneath which the soil is usually frozen to a great depth. In summer these valleys are transformed by the melting snow and the surface thawing into morasses and swamps, through which travel on foot or on horseback is a slow laborious process. As one leaves the stream valleys the timber becomes lighter, and on the hill slopes fairly good ground may be found. In a few places considerable areas of dry gravel bench exist, but nowhere is it possible to use wheeled vehicles over any considerablbe distance except on the roads.

Alaska's Transportation System

First in importance in Alaska's transportation facilities are the splendid existing coastal and interior waterways. Essentially an overseas country from the United States, the open waters of the Gulf of Alaska and southeastern Alaska are virtually Alaska's richest possession. After these come the easily navigable (although open but five months of the year) rivers of the Yukon, Tanana, Kuskokwin, Kantishna, Iditarod and Koyukuk. The waterborne commerce upon these rivers and ocean waters is, and always will be, the chief life giving element in Alaska's commerce.

Next to the water-borne commerce in importance comes the land transportation connecting up base ports and waterways. Two means exist, of course, railroads and wagon roads. As to railroads, with the completion of the Government Railroad from Seward to Fairbanks, about $100,000,000 will have been invested from public and private funds in railroads.

As to wagon roads, the nature of the commerce existing and expected in Alaska is such as to make them especially necessary. The Government Railroad, now nearing completion, will be of little value until the commerce of the country passed through is brought to the railroad upon tributary highways But in providing such roads, the immediate construction of numerous feeder roads constructed to fit only the topographical features of the territory, even if the fabulous cost could be met, would give but meager return. These feeder roads must be built with a careful consideration of both the topography of the country passed through and the economic return to be expected. Finally, before the tonnage which the Government Railroad can carry materializes, it will be found that an amount equal to that spent upon its construction must be invested in tributary wagon roads. To enable a substantial development of this generous federal project to take place, to aid in the balanced development of all parts of Alaska, a modest but thoroughly considered program of wagon road construction has been presented.

Terminal and Harbor Facilities

All ports in southeastern and southwestern Alaska, as far west as Cook Inlet, are open to shipping all the year round. All Alaskan ocean ports, except Nome and St. Michael, are well equipped with docks at which ships may lie in almost all weather. Anchorage is frozen up for about five months in the year, and Nome and the Yukon and other river ports for about seven months. All cargo must be handled by ship's tackle. Skagway, Cordova, Seward, Anchorage, Nenana and Fairbanks have rail connections from the docks to the interior.

Resources

The agricultural resources of Alaska are just beginning to be developed. Local markets are now supplied with potatoes and other root crops, garden truck, hay, berries, and limited amounts of cereals. Two grist mills have been taken into the interior. When more attention is paid to agriculture, particularly to the selection of suitable varieties, the Tanana, Sustina and Matanuska Valleys and several smaller districts can be made to supply the markets for a greatly increased population. The backward state of agriculture is partly due to the fact that the present population is made up of miners rather than of farmers. The agricultural output will probably never exceed the local demand.

The timber resources of Alaska are very extensive and important, especially in spruce and hemlock in the southeastern section. Extensive stands of birch suitable for furniture are found in the interior. In spite of the inferior quality of Alaska timber, it not only answers for local use but is being exported in increasing quantities; 50,000,000 feet were cut in 1919. About an equal amount ($1,600,000 worth) of lumber, principally Douglas fir, was imported from the United States. Recent water power legislation favorable to the wood pulp industry has already resulted in several projects. It is estimated that Alaska can furnish indefinitely one-third of the pulp paper used in the United States.

Moose, caribou, reindeer, mountain sheep, goats, ducks, grouse, etc., furnish considerable food supply to the present population in the interior, but there is little revenue from the exportation of game. The reindeer herds have increased sufficiently, however, to justify the expectation of the exportation of an increasing amount of frozen meat. Attention is now being given to the possibilty of handling musk-oxen in substantially the same way. Marten, mink, bear, muskrat, lynx, ermine, fox, etc., are exported in gradually decreasing amount but in increasing total value. Seal has produced large amounts, but it has been until recently, completely protected. Beaver is still protected. Furs produced about $4,175,000 in 1919.

Salmon is the principal product of the fisheries, but large quantities of halibut, cod, herring, and whales also are secured. The fisheries have been the principal support of the south and southeast coast population to date. The output was $52,000,000 in 1919.

The following minerals are developed and producing in order of value: Gold, copper, silver, coal, lead, tin, platinum, palladium, marble, gypsum and petroleum. The following have been discovered but are undeveloped owing to the high cost of transportation or to government restrictions: Zinc, antimony, quicksilver, peat, asbestos, graphite, as well as low grade deposits of all of the preceding list. Output for 1919 in gold, $9,000,000; in other metals, $10,000,000.

Total Production

	To 1919	and 1919	1919
Total mineral production	$418,000,000	$19,250,000	$437,250,000
Total commerce for 1919			120,000,000
All products, to include 1920			1,000,000,000

Original Condition

Prior to the organization of the Alaska Road Commission, there were, in the whole of the Territory, less than a dozen miles of what might be called wagon road, with a few hundred miles of pioneer trail, mostly constructed by expeditions under the War Department. Travel was largely confined to the open waterways in summer and to their frozen courses in winter. When mining machinery and other supplies were to be transported from the coast or river landing, they were in most cases hauled over the snow during the winter, with some prelimnary clearing of the route when necessary. Travel across country in summer, generally speaking, was possible only on foot or with pack horses. It was difficult always, and frequently dangerous, on account of the numerous swift and deep streams, fed by the ice-cold waters of mountain glaciers.

Previous Projects

In the summers of 1898 and 1899 War Department expeditions made explorations whch collected much valuable data regarding the country and the best natural routes of travel. For the fiscal year, 1901, Congress appropriated $100,000 for roads and trails in Alaska, to be expended under the War Department. Practically all of this was spent on the route leading from Valdez to Eagle, but was sufficient only for the construction of a crude pack trail through sections otherwise impassable and the building of some of the most necessary bridges along the route. In the summer of 1904 an appropriation of about $30,000 was made for a survey and estimate for a wagon road along this route. The survey was made under the direction of the Chief of Engineers.

Results

Since the organization of the Alaska Road Commission in 1905, there have been expended, under its direction, about $6,000,000. About half of this money originated from appropriations carried in the annual bills for the support of the Army. Over two millions of dollars have come from the "Alaska Fund" and the balance has consisted of funds of the Department of Agriculture for expenditure within the Tongass and Chugach Forest Reserves; money directly appropriated by the Territorial Legislature, and various funds contributed by communities or private individuals. The system for the improvement and maintenance of which the Alaska Road Commission is now responsible includes 4,890 mi., of which 1,031 mi. are classified as wagon roads, 636 mi. as sled roads and 3,223 mi. as trails. Four thousand six hundred miles of this system form connected routes, reaching from the open South Coast ports to the Arctic Circle and to the Kotzebue Sound Country above Bering Straits, affording a communication by road or trail to practically every settlement, within Alaska, except those in the southeastern panhandle and the isolated coast towns.

The work of the past fiscal year has been largely maintenance of the existing mileage of wagon roads, sled roads and trails. Substantial progress was made in this respect, with the result that two-thirds of the length of the Fairbanks-Chitina Road has been given a gravel surface. During the early summer of 1920 an automobile drove over this 320-mi. road in 22 hours actual running time. In August, 1920, an automobile made the trip over the Fairbanks-Valdez road in 25 hours actual running time for the first 352 mi. The remaining 18 mi. were made in two hours, including 3 mi. on foot around the relocation through Keystone Canyon.

Mail was handled by automobile on 160 mi. of the Richardson Road between Chitina and Fairbanks during the entire winter. The use of automobiles has not been encouraged by the Commission, but their number is increasing rapidly. Approximately 90% of the traffic on the main wagon roads is handled by motor, which has greatly increased the cost of road maintenance.

Future Road Development

The Alaska Road Commission has, up to the present time, undertaken work on 50 different routes.

In 1913 the Commission drew up a comprehensive program of road construction and development to cover the succeeding ten years. This project was based upon (a) the maintenance and improvement of the existing projects, (b) the completion of projects already undertaken, (c) the completion of projects already approved but not then undertaken, and (d) the completion of projects likely to arise with the development during the 10-year period. This program called for a total expenditure during the 10 years, 1914-23, of $7,250,000 and would have resulted in providing Alaska with a complete road system such as its immediate needs seemed to justify, and probably sufficient to meet all reasonable demands until the territory became sufficiently developed to take over all internal public works as a part of its own government.

This program was also based upon the assumption that governmental restrictions and red tape would be removed and the territory allowed to develop normally as in the case of our other great western territories. The enormous expenditures contemplated that same year for a Government railroad seemed to augur a more liberal attitude on the part of the Government. Seven years of that period have now passed by and three factors have arisen to derange those calculations: First, the Great War, second, the lack, until this year, of any indication of a change of attitude, on the part of the Government looking to a rational policy of Alaskan development; and, third, an average expenditure per year of only $375,000, instead of $725,000, for the past seven years for road and trail work. For the two years of the war the total appropriations were only $370,000 or $185,000 per year—only one-fourth the average required.

The new commission, feels that the war is sufficiently past to permit of the United States taking up a new program involving an expenditure of $1,000,000 a year for a period of 10 years. This program is based upon the same general considerations as the 1913 program, but takes into account also the following new factors: First, the damage and deterioration of the existing project during the lean war years; second, the increased cost of labor, materials, and supplies; third, the provision of a system of feeders for the Government Railroad; and, fourth, the necessity of providing a more substantial type of construction to withstand motor traffic.

This program was prepared in cooperation with the Forestry Service and the Governor of Alaska. It is given in detail in our annual report for the fiscal year ending June 30, 1920.

Technical Considerations

According to the classifications of the Alaska Road Commission, wagon roads are any roads cleared, grubbed, ditched, graded and drained sufficiently to accommodate wagon traffic. Under our present plans these roads are being provided with a gravel surface to withstand motor traffic. Sled roads are cleared and graded like wagon roads, but not closely grubbed. They are drained only sufficiently to prevent their destruction by the summer rains. Their wearing surface is of snow. They are passable for heavy loads carried upon double bob sleds and drawn by 4, 6, 8, or more, horses. Trails include any construction less than the above, suitable for single horse double-ender sleds or dog sleds in winter and pack horses in summer. Except where river surfaces are used, some work is always necessary to permit the use of dog teams.

Road construction in general is possible only during the summer season, which varies from three to six months in different parts of the territory. The winter is utilized for the freighting in of heavy supplies, bridge timbers, forage, etc. Many bridges are also erected during the winter when the ice may be used in lieu of falsework, and the glacial torrents of the summer are avoided.

The principal office of the Commission is at Juneau, the capital of Alaska. District offices are maintained at Valdez, Fairbanks and Nome. Expenditures have been distributed as follows, including maintenance:

For wagon roads	$4,433,300.00
For sled roads	286,200.00
For trails	402,875.00
For examinations, reconnnaissance, etc., not followed by construction	57,483.97

The annual cost of maintenance of routes in Alaska varies considerably with the locality, the range of climate being greater than that of the United States and the cost of labor also varying greatly. The experience of the Road Commission indicates that for all Alaska proper, average construction and maintenance costs, including bridges, are about as indicated in the following table:

Classification	Cost of Construction Per Mile	Annual Maintenance	Total Cost per Mile 1905-1920
Wagon Roads	$2500	$250	$4300
Sled Roads	300	25	450
Trails	100	10	125

Note. For earth roads only. Higher classes of construction cost more but have proportionately much less maintenance charges. As the mileage increases, the total maintenance charges increase, so that smaller proportionate amounts are available each year for new construction.

The costs of transportation by the usual modes of transport in Alaska are shown in the following table:

Winter	Per ton-mile
Bob-sled (sled road)	$0.37
Double-ender (trail)	0.62
Dog-team (trail)	2.07
Summer	
Truck (wagon road)	0.54
Wagon (wagon road)	1.23
Pack train (trail)	4.80
Man (no trail)	26.67

(Continued on page 136)

Difficulties Experienced by the States in the Matter of Rail Transportation*

By S. E. BRADT†

The difficulties encountered in Illinois have not differed materially from those encountered in the states of the Mississippi Valley and probably are similar to the difficulties encountered in all of the states attempting to carry on a large program of highway construction.

Shortly after the signing of the armistice in November, 1918, the states were urged by the U. S. Department of Agriculture to proceed as fast as possible with the construction of roads, with money made available from the federal appropriation. This was urged because of the possibility of idle labor due to the slow absorption of the released army into their ordinary pursuits and because of the releasing of the thousands of people employed in war industries.

Illinois, acting in harmony with this suggestion, proceeded to make preparations, and awarded contracts for about 570 mi. of hard-surfaced roads, costing some $32,000 per mile. It was hoped that at least 400 mi. would be completed during the 1919 season. This was a new era of road building in Illinois; hence, many contractors were obliged to buy complete equipments, and all of them at least some additional equipment. The manufacturers, instead of being able to furnish them equipment withn 30 days, as promised, required from 60 to 90 days to make delivery. This prevented an early start on the part of the contractors. As soon as the contractors were ready for the delivery of material, a shortage of open-top cars developed. This was followed by the shopmen's strike, which crippled the motive power of the railroads; and later in the season came the coal strike, in anticipation of which all open-top cars were taken from the bulding industries and sent to the coal mines. The result was that instead of 400 mi. being completed, we ended the season with 170 mi. of finished roads and carried over to the 1920 season approximately 400 mi. unfinished.

The Bond Issue Law called for construction at the rate of approximately 1,000 mi. per year. Accordingly, we made tentative plans for putting that mileage under contract for 1920 construction. Because of the handicap placed upon the 1919 construction work through the inability of the railroads to furnish sufficient equipment for the transportation of material, we visited the officials of the Railroad Administration with a view to ascertaining the possibility of obtaining cars if we undertook a program involving the addition of 1,000 mi. of roads. We explained to them that the building of 1,000 mi. of roads meant the delivery of 1,000 cars of material a day. Figuring that each car would consume eight days in making the round trip, our requirements would be at least 8,000 cars continuously during the highway construction season. We were advised that in the spring of each year, from Mar. 1 to July 1, there was ordinarily a supply of a quarter of a million or more of idle cars, and if we could arrange to have a large portion of our material delivered before July they would be able to take care of our requirements. In accordance with these suggestions from the officials of the Railroad Adminstration, we arranged with our contractors for the storage of the materials. They began in February and March to call for cars, but instead of the required number of cars being available it developed that the year 1920 was unlike any of the preceeding years and that there was no surplus of idle cars available. As a result, few contractors were able to get a supply of material stored in advance for construction. As soon as we asked for bids on new construction it also developed that owing to the uncertainty of transportation, the increased price of labor and material and the uncertainty of the general situation, our bids, instead of averaging $32,000, as in 1919, averaged $44,000 per mile. With all these things facing the department, it was decided to reject bids and to award contracts for only about 50 mi. instead of the amount originally planned, putting all of our efforts into the completion of this 450 mi. To this end, Governor Lowden called a conference of both producers of materials and the railroad presidents, all of whom pledged the fullest possible measure of co-operation in the carrying out of the plans of the department, and it is but fair to say that in our opinion this pledge was fulfilled to the best of their ability.

The contractors who were working in 1919 closed the season with approximately 100 paving machines on the ground, ready to start the 1920 construction work as soon as materials were available and weather conditions suitable. At no time during the entire season however were there more than 53 of the 100 machines in operation, and the average for the season was much less than 53. This situation was due almost entirely to insufficient transportation facilities.

The first interference with our work came in the shape of a switchmen's strike, which caused a congestion of freight cars in practically all of the centers of population in this vicinity and prevented their movement for a number of weeks. However, the most serious difficulties experienced have been the various orders issued from Washington by the Car Service Commission and the Interstate Commerce Commission. Early in June the former commission issued an order requiring that coal mines should be given 50% of their rated car requirements, and that plants producing other commodities, requiring open-top equipment should be restricted to the use of the remainder of the cars, whatever that might be, but not exceeding, to any one plant, more than 50% of its output. This immediately reduced the shipments of road materials. This order was followed on June 21 by another order, issued by the Interstate Commerce Commission, providing that open-top cars could be used for hauling material other than coal only when returning in the direction of the mines. This order was to be in force only 30 days, but was renewed at the end of each 30-day period and remained in force throughout the construction season. Perhaps 50% of our contractors were doing work in localities that permitted all of the material for their work to be handled in accordance with this order without interruption. The other 50%, however, were getting material in localities requiring a "back-haul," which was in violation of the above ruling. Within a short time after the order went into effect the material coming to them was stopped. We appealed to the Interstate Commerce Commission and a hearing was called early in July. The result of this hearing was the issuing of special permits, but only after a delay of several weeks. These permits were granted only for the hauling of material for the completion of old contracts where work was being done on sections of important roads. Our work was all being carried on upon the main highways of the state. Accordingly, by the middle of August we had secured permits for most of those contractors requiring a "back-haul" for their material. These permits were generally put into effect by the railroads, but occasionally some road would get an order from Washington to deliver a certain number of cars to some special plant for a specific coal loading, which, of course, interferred with work in that vicinity.

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*Paper presenteed at the sixth annual convention of the American Association of State Highway Officials, Washington, D. C., Dec. 13-16, 1920.

†Superintendent of Highways of Illinois.

In September, an order was issued from Washington suspending all permits for a period of ten days. This again held up the movement of material for road work. At the expiration of the 10-day period road work was resumed; but early in October another order came from the Interstate Commerce Commission canceling all permits and requiring that additional evidence be submtted before those permits would be renewed. We succeeded in securing the renewal of not more than five of the old permits. Because of this interference, mainly through the two commissions above mentioned, we have been able to complete only a little more than 300 of the 450 mi. In order to do this, much of the time of the offlcals of the department, as well as all of the time of experts hired for that purpose, has been given to the securing of car equipment and connecting it up with the producers of road materials so as to keep contractors supplied with as large an amount of material as possible.

During the seasons of 1919 and 1920 we have built 500 mi. of high-class, hard-surfaced roads. The same effort put forth under ordinary conditions and without the hindrances herein enumerated would easily have completed 1,000 mi. of the same class of roads, which result would have proven reasonably satisfactory to our people.

As a result of this situation it will be seen that the people of this state have suffered great inconvenience because of the inability of the contractors to finish their work promptly and that the contractors have been subject to excessive losses because of insufficient transportation facilities.

It will also be seen that the producers of material, through their failure to secure cars for a normal output, will be subject to losses, due to the fact that the overhead expenses remain practically the same under a reduced output as under a normal output.

All of these losses will in a large measure come back to the people in the added cost of construction of future work.

We cannot remedy the past; our problem lies in the future.

We have the contractors.

These contractors have the equipment.

Labor has been in fairly good supply this year and the indications are that it will be more plentiful next year.

The money is available.

Materials are in ample supply at their source.

As near as we can judge, the one principal limiting factor in 1921 will be transportation. Insofar as the railroads are able to solve this problem of transportation by the purchase of added railroad equipment, by the repair of present equipment, by increasing the number of car miles per car per day so as to carry on our work without governmental interference, just so far the improvement of the highways of Illinois and other states in the Mississippi Valley will be carried on in an increasing portion. This is the important problem.

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The City of Akron, Ohio, spent $288,855 on street repair in 1920.

An Engineers' License Bill was recently introduced in the Texas Legislature.

Winnebago County, Wisconsin, plans to construct 13 mi. of concrete highway during 1921.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
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Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI MARCH 2, 1921 No. 9

CONNECTICUT HIGHWAY FUNDS

A cut of approximately 25% has been made in the amount of money available to the Connecticut State Highway Department, according to a recent report.

Though the department will still have at its disposal a sum that would have been considered large a few years ago, there is room for doubt as to whether or not the sum will suffice for even the immediate needs of the state. During the past few years highway traffic in Connecticut has grown with extraordinary rapidity, due in no small measure to the unspeakably poor service rendered by the New York, New Haven & Hartford Railroad which handles practically all of the freight shipped out of or into the state by rail.

Connecticut has been one of the foremost states in road improvement and the present is no time to curtail its activities along that line.

BUILDING ROADS IN ALASKA

In point of general, rather than technical, interest few recent convention papers have surpassed that by Col. James G. Steese, President of the Alaska Road Commission, which is printed on other pages of this issue. The paper was one of those presented at the recent A. R. B. A. convention at Chicago, and its interest was greatly enhanced by the explanations and amplifications interpolated by the author during its presentation. It is a matter of regret that those cannot be produced here.

A careful reading of the paper will be distinctly worth while. Though most of us have a vague idea that Alaska is a big territory with enormous natural resources, comparatively few of us have any accurate, definite knowledge of it. In the same way we have a hazy idea that considerable road work has been and is being done there, but we lack specific knowledge and a realization of the magnitude of the problem or of its peculiarities.

All of this information and much more is included in the paper by Col. Steese. It is highly instructive and remarkably interesting reading.

INDIANA HIGHWAY OFFICIALS LOOK FOR LOWER MATERIAL PRICES

The awarding of road contracts in Indiana has been held up in the hope of lower road material prices, according to a recent announcement from the highway department of that state.

In view of the general trend of costs, it would seem resasonable to expect lower prices of those materials used in the construction and maintenance of roads. Yet some of the men in closest touch with the road material market have expressed the belief that no considerable drop in prices can be expected.

The action of the Indiana officials is in line with the demand for economy that is becoming more and more evident, but a policy of retrenchment is commendable only when it does not interfere with the prosecution of necessary work. In spite of the present high cost of roads, money spent for them is money very well invested.

CONTRACTORS' WAR LOSSES

Two recent news items indicate that road contractors are likely to suffer material losses because of conditions brought about by the war. A recent decision in New York State holds the Knight Law unconstitutional and a Pennsylvania county court has ruled that war-time legislation does not relieve road contractors of the duty to complete their contracts at specified prices.

High costs, becoming effective after the submission of bids, and the signing of contracts in many cases; adverse legislation, and almost insurmountable transportation difficulties have made the lot of the road contractor during the past two or three years an unenviable one. In New York a considerable measure of relief was promised by the Knight Law, by which contractors were to be at least partially reimbursed for losses sustained because of war conditions.

It is to be hoped that it will yet be possible to find some way of lifting a part, at least, of the contractors' burden.

Indiana to Wait for Lower Prices

Contracts for building roads included in the 1921 construction program of the Indiana highway system will not be awarded until there has been a decline in the price of materials, according to a recent announcement by L. H. Wright, Director of the State Highway Department. Mr. Wright stated that he believed that it would be early in March before any action would be taken on the letting of contracts.

Connecticut Road Appropriation Cut

The Connecticut State Board of Finance has made reductions of $1,100,000 in estimates of the State Highway Department. Since the total of requests made by this department was $4,226,500, this represents a cut of nearly 25% of the amount asked.

Adding $6,000,000 as the estimated aggregate of fines, forfeitures and fees that may be expected under the motor vehicle law, the amount allowed to the Highway Department by the Board of Finance will make $9,226,500.

Pennsylvania Court Holds Contractors Liable on Ante-Bellum Contracts

Road contractors were not relieved of their responsibility to complete the work at the specified price by war-time legislation, according to a recent opinion of Judge W. M. Hargest, of the Dauphin County, Pennsylvania, Court. Judgment was rendered to the state in the cases of Dwyer & Co., and bondsman, the New Amsterdam Casuality Company, and Neff, Horn & Co., and bondsman, the Globe Indemnity Company.

Bridge Will Span Grand Canyon

All Materials Used in Construction of Suspension Bridge are Packed by Mules

The National Park Service has commenced the construction of a 500-ft. suspension bridge across the Granite Gorge of the Colorado River, making the north rim of the Grand Canyon National Park in Arizona accessible to tourists. The bridge will be of light and simple construction and adapted to foot and mule traffic because all materials must be packed by mules down narrow trails. The north rim of the park, about 1,500 ft. higher than the south rim, has heretofore been little visited because of its inaccessibility.

The gorge is about 420 ft. wide at the point where the bridge is being erected, with almost perpendicular sides. The bridge will be a wire suspension structure with a length of about 500 ft., swinging about 40 ft. above the general water level. Materials must be transported by mules for a distance of 10 mi. The stirrup rods of the bridge must be folded for packing and even flooring sections must be cut to not more than 9 ft. to get them around corners.

The great weight of the main cables give use to a difficult transportation problem. It is planned, however, to meet the situation by placing the cables on mules so that a cable is on either side of a string of mules, with about 25 ft. between mules.

The Twelfth National Good Roads Show Under the Auspices of the A. R. B. A.

(Concluded from page 126)

and literature. H. E. Billington, C. B. Watrous, H. A. Hutchins.

Titan Truck Co., Milwaukee, Wis. One Titan subgrade truck. J. C. Millman, H. West, George Streick.

Tower Motor Truck Co., Greenville, Mich. One 2½-ton truck with dump equipment. F. E. Davis.

Turbine Sewer Machine Co., Milwaukee, Wis. Sewer cleaner. Philip A. Fuchs.

Tyler Co., The W. S., Cleveland, Ohio. "Hummer" electric vibrating screen; portable "Whip-Tap" screen. Albert E. Reed.

U. S. Bureau of Public Roads, Washington, D. C. Methods of testing road materials; demonstration of the impact effect of motor trucks on roads; investigation of subgrade materials and conditions; cement testing; concrete investigations; pictorial exhibit of federal aid roads. C. B. Smith, C. A. Hogentogler, C. E. Proudley, J. R. Boyd, B. A. Anderton.

Universal Concrete Bar Co., Chicago, Ill. Expansion joint bar, curb bar. E. W. Schmidt.

Ward La France Truck Corp., Chicago, Ill. One 3½-ton truck with dump body. B. F. Cullen.

Warren Brothers Co., Boston, Mass. Pavement samples and literature. P. S. Kaull.

War-Son Petroleum Co., Chicago, Ill. Road oils. George J. Miller and W. A. Lone.

Western Wheeled Scraper Co., Aurora, Ill. Cars, batch boxes and track for industrial railways; photographs, and literature. H. B. Bushnell.

White Co., The, Cleveland, Ohio. Two White motor dump trucks. H. S. Jenkins, F. M. Hayden and C. B. King.

Wiard Plow Co., Batavia, N. Y. Combination road plow. S. J. Hunt.

Williams Co., The G. H., Erie, Pa. Demonstration stand and four model buckets; photographs, and literature. T. R. Buss.

Willite Road Construction Co. of America, New York, N. Y. Pavement samples and photographs. Maj. H. W. Wilson and John G. Tait.

Winther Motor Truck Co., Kenosha, Wis. One 15-ton truck. H. D. Snyder, R. G. Wine.

Wood hydraulic hoist and 3-yd. steel dump body, hydraulic and steel dump body for Ford chassis, horizontal hydraulic hoist and 2-yd. steel dump body.

Road Work in Pennsylvania

The State of Pennsylvania built 410 mi. of road during 1920, besides resurfacing 577 mi. of macadam road and surface treating 1,480 mi. of road. The plans for 1921 include the completion of 350 mi. of concrete road and the letting of 350 mi. of concrete road in addition.

Reorganization of Ohio State Highway Department Proposed

A bill providing for the abolition of the Ohio State Highway Advisory Board has been passed by the State Senate. This measure was recommended by Governor Davis and it is expected that it will pass the House of the Ohio Legislature.

$55,000,000 Bond Issue Proposed for New Jersey

The New Jersey State Highway Commission has approved a plan for a proposed state issue of $55,000,000 bonds bearing 5% interest, to be used in completing the state highway system and building and reconstructing bridges. Commissioners Paddock and Doughty have been appointed to present the matter to the Legislature. Motor vehicle fees and the present 1-mill tax would be used to pay interest and principal of the bonds.

Kansas May Make Paving Brick

The Kansas State Geological Survey has reported that deposits of shale at Lansing are suitable for the manufacture of paving brick and the State Board of Administration is considering the advisability of the state's manufacturing its own paving brick. At the present time the state is operating building brick plants at Lansing and, according to Dr. R. C. Moore, State Geologist, sufficient machinery to manufacture paving brick can be added at relatively small cost.

Arkansas Highway Law Defective

The Arkansas highway department act has been declared defective by the state auditor because it contains appropriation provisions for two different purposes.

The act, which has been signed by the governor, provides for the payment of salaries and maintenance expenses out of the highway fund, and also for the repayment of money to purchasers of state lands who did not get title to the land. The appropriation for these items, comes out of the fund created by the sale of state lands, which is entirely apart from the highway fund. Under the state laws appropriations from two separate funds and for two distinct purposes may not be made by the same measure.

Last Toll Road in New Jersey Freed

With the recent resolution of the New Jersey State Highway Commission authorizing the purchase of the old Gloucester Turnpike in the southern part of the state, the last toll road in the state will be freed. The amount authorized for the purchase of this road is $70,000.

Chile Will Build Roads

The Chile Council of States has approved and sent to congress a bill providing for the expenditure of 50,000,000 pesos in the next two years for public improvements. The work anticipated includes the improvement and construction of highways and the building of waterworks in various small towns.

Bridge Construction in Quebec

During the year ending June 30, 1920, the Province of Quebec, Canada, had 117 bridges under construction, of which number 50 were completed. Bridge work was delayed during the year because of inability to secure adequate cement supplies. In addition, the Department of Public Works had a number of projects under consideration.

Reorganization of New Jersey State Highway Department Proposed

A bill has been introduced in the New Jersey Legislature by Senator White proposing the abolition of the present State Highway Commission and the appointment of a state highway commissioner at a salary of $15,000 a year, a state highway engineer at $10,000 a year, and three division engineers at $6,000. The proposed commissioner would be appointed for three years and the present non-salaried commission would go out of existence in ten days after passage of the measure. If the bill passes it is expected that Governor Edwards will appoint T. J. Wasser, now State Highway Engineer, as commissioner.

More Federal Aid Opposed by Senate

Efforts to attach as a rider to the Post Office bill an appropriation of $100,000,000 for road construction, failed on Feb. 18 in the U. S. Senate. A motion to insert the appropriation was lost on a vote of 41 to 33, or 9 less than the required two-thirds majority.

Rejection of the rider is regarded as foreshadowing defeat for further road appropriations at this session. The bill which passed the House, appropriating $100,000,000 for federal aid, is before the Senate Post Office Committee and Chairman Townsend does not plan its consideration at this session.

Senator Townsend led the fight on the rider, declaring that present road appropriations savored of "pork barrel" requests.

Would Amend Indiana County Road Law

A bill was recently introduced in the Indiana Legislature which provides that instead of the county paying the entire cost of the construction of county roads, half of the cost will be paid by the county, one-fourth by townships and the other fourth by property owners within a mile on each side of the road. The bill also provides that county road projects may be taken up only on petition of 200 property owners, instead of 50 as at present.

Progress on Lincoln Highway

Although the year 1920 gave rise to many conditions adverse to road work, 548 mi. of the Lincoln Highway were improved during the past season New Jersey constructed on this highway 14 mi. of concrete roadway; Pennsylvania spent about $1,662,000 for construction and maintenance; Ohio built 19.5 mi. and has let contracts for 53.7 mi., at an estimated cost of $507,612; Indiana planned to construct 40 mi. of concrete roadway on this highway, but it was possible to complete only 10 mi.; Illinois built 51 mi. of 20-ft. concrete road at a cost of $2,180,000; Iowa did considerable grading and bridge building, spending $643,545 for improvements on the Lincoln Highway; Nebraska built 70 mi. of gravel roadway; Wyoming improved 237.5 mi. at a cost of $530,396; Utah spent about $160,000 for work on the highway; Nevada spent $788,237, and California spent $115,157.

The association completed the marking of the road from the east coast as far west as Omaha, Neb., at a cost of $30,000.

New York Law Reimbursing Contractors for War Losses Held Unconstitutional

Court of Appeals Holds Invalid Knight Law Appropriating $7,450,000 for Contractors

An important decision was handed down by the Court of Claims of New York on Feb. 2, declaring unconstitutional the Knight Law, passed in 1919 to reimburse contractors for losses sustained during the war because of the increased cost of labor and material.

In 1920 the Legislature apropriated $3,450,000 which, in addition to the $3,000,000 appropriated in the previous year, made $7,450,000 available with which to reimburse the losses on contracts, most of which were for highways. Claims have been filed in accordance with the act for about $5,000,000.

This decision was rendered in the case of the Dale Engineering Co., which sought to recover $27,405. In the opinion of the court it is set forth that the Knight Law is unconstitutional both because it allows extra compensation to contractors and also because it audits and allows private claims against the state.

Road Building in Alaska

(Continued from page 130)

Railroad transportation cannot yet be regarded as a usual form for Alaska, and steamship rates are entirely arbitrary, depending upon competition. They, like the existing railroad rates, have been fixed by two factors only: First, the cost of hauling on some competing wagon road, sled road, or trail, where such competition exists (or, in the case of steamships, sometimes by competing steamer line); and second, by the highest rate the freight can stand and be shipped at all.

The table shows the actual costs at the rates for teams, labor, food, forage, etc., prevailing in the great interior regions of Alaska. They are based also on the costs of hauling large quantities. On the south coast the comparative values are the same, but actual values are about 1/3 less because of lower costs of above controlling elements.

During the opening of new diggings in the Chisana region a few years ago, beans, coffee, sugar, hay, candles, bacon, grain, etc., were sold at $1.50 per pound. The freight charges were almost a dollar a pound, so that the original cost of the article was of relatively little importance. And even at that, the supply could not keep pace with the demand. Last summer the freight charges for transporting supplies from Dawson in the Klondike to some mines about 100 mi. away in the American 40-mile District were greater than the original cost of the suplies plus the freight from U. S. to the Klondike. (Dawson is 1,700 mi. from Seattle.)

The roads and trails already constructed by the Alaska Road Commission have been of great economic value to the territory. Statistics collected for the few years immediately preceding the war, indicated that the economic saving to shippers, comparing the expenditures for freight on each route at the present rate with the cost of transporting the same amount of freight at the rates prevailing before the road was constructed, was about $2,000,000 per year. A new census has now been inaugurated but the returns are not yet in.

Conclusion

Alaska has been slowly developing for twenty-two years. Sixteen years ago the first steps in road construction were taken. The first steps in railroad building were made even earlier, but so far all have been unsuccessful, chiefly because the railroads could land freight only at their freight platforms and had no road feeders to distribute their tonnage. No railroad can be successful without roads as branches or feeders, any more than a tree can grow by its trunk alone without branches and leaves.

(Concluded on page 139)

HIGHWAY TRANSPORTATION

Would Legislate Heavy Trucks Off New York Highways

A bill has been introduced in the New York Legislature by Senator Hewitt which proposes to double the fees on motor trucks up to 5 tons capacity . A tax of $500 would be placed on a 5-ton truck, with an additional $100 for each additional ton capacity. "The big trucks," said Senator Lowman, who helped Senator Hewitt prepare the bill "are destroying the roads for which the taxpayers have paid millions of dollars. It is impossible for the Legislature to bar the big trucks from the road. Our only means of protecting the highways is through placing a tax on the big trucks that will be prohibitive."

New York University Adds Course in Automotive Transportation

A course in automotive transportation has been added to the regular course in industrial engineering at New York University. F. V. Lane, formerly transportation engineer of the Packard Motor Car Co. and now general maintenance manager of Hare's Motors, will be in charge of the course. The course will include the following lectures: The Future of the Motor Truck; Motor Truck Operating Costs; Motor Trucks versus Horses; Motor Trucks versus Railroads; Trailers and Semi-trailers; Special Bodies; Loading and Unloading Devices; Routing and Dispatching; Maintenance and Garaging; Hiring, Training and Retaining Drivers.

"Safe Roads Week" in Massachusetts

The state council of the Safe Roads Federation of Massachusetts has voted to recommend that the first week in April be observed as a "Safe Roads Week" throughout the state, in an effort to reduce the number of highway accidents.

In a statement issued by the federation it is stated that excessive speed is the chief cause of motor vehicle accidents. Out of a group of 394 accidents recently analyzed by the federation, 135 were caused by speeding, 54 by children darting in front of automobiles, 46 by operators being on the wrong side of the road, 39 by intoxicated drivers, 23 by inattention on the part of operators, 19 by pedestrians running across the street and 16 by pedestrians stepping from the sidewalk directly in front of automobiles.

The Massahcusetts branches of the National Safety Council, chambers of commerce and automobile clubs have offered their cooperation in the observance of the "Safe Roads Week."

Automobiles Carry Former Passengers of Short Railroad

The Chesapeake & Western Railroad has petitioned the Virginia State Corporation Commission for permission to abandon passenger service on the road, representing that motor travel on improved highways paralleling its line has seriously affected its passenger traffic, causing this service to be operated at a loss. The railroad is 50 mi. in length, extending from Elkton to Stokesville, connecting with the B. & O. and Southern Railroads. Freight service will be continued.

Compulsory Motor Vehicle Insurance Proposed in Pennsylvania

A bill has been introduced in the Pennsylvania Legislature making the insurance of motor vehicles obligatory and making owners of motor vehicles liable for damages and injuries caused by the negligent operation of such vehicles. Owners of motor vehicles may secure exemption from insurance, if they furnish information showing financial ability to pay the probable amount of damages. Upon failure to comply with the provisions of the bill, the license of the owner would be revoked.

Right to Operate Buses Upheld

Court Holds Street Railway Has No Basis of Action to Restrain Bus Competition

In a test suit against William Reinhardt of Newark, N. J., a bus operator, by the Public Service Corporation, which operates street railways in Newark and other nearby cities, to restrain the use of jitney buses on the public highways, Vice Chancellor Griffin rendered a decision in favor of the defendant. The precedent handed down is far reaching and will, it is said, be cited on behalf of bus operation on routes competing with New York City surface lines.

"The right of the people," said Vice Chancellor Griffin, "to use the public highways of the state freely and without hindrance, subject only to proper police regulation, unless the Legislature should otherwise ordain, is unquestioned. And in the exercise of this right, the people are not exercising a franchise. Thus, persons complying with the Kates Act (which regulates bus operation) do not acquire a franchise to use the public highway.

"The act is prohibitive only if the defendant takes away rights formerly possessed. The plain purpose of the act was not primarily to license, but to regulate and control the operation of vehicles in the crowded streets of the cities for the public benefit and safety and for revenue.

"It was not passed for the benefit of the street railways. The franchise of the complainant is as to its tracks and ways and gives it the exclusive use thereof as against competing carriers in the manner indicated in Camden Horse Railroad Company vs. The Citizens' Coach Company. It has no grant outside of the tracks and, therefore, when it seeks to enjoin competing carriers from using a highway in a manner declared lawful under Camden Horse Railroad Company vs. The Citizens' Coach Company, I feel bound to hold that it has no standing in this court to ask for injunctive relief."

EQUIPMENT—TRADE—MATERIALS

Cement Companies Plan Merger

A plan for the consolidation of the Alpha Portland Cement Co., of Easton, Pa., and the Cement Securities Co., of Denver, Col., has been worked out by a number of large stockholders of these companies and will be submitted for ratification. If the stockholders approve the plan, the new company will control the annual production of over 12,000,000 bbl. of cement.

A New Excavator Crane

A new excavator crane of large capacity and full tractor type has been brought out by the Pawling & Harnishfeger Co., Milwaukee, Wis. The corduroy traction consists of 20-in. wide cast steel treads and the sprockets which are placed on 9-ft. centers are of manganese steel, bronze brushed and adjustable to take up wear. Because of its short turning radius, a complete turn in twice its width being possible, the machine is handled with ease. Two traction speeds are provided.

NEW P. & H. EXCAVATOR CRANE NO. 206

The power plant consists of a 4-cylinder Waukesha heavy duty motor of 50 hp., with Warner vacuum feed so that fuel is supplied to the engine regardless of the position of the crane. A storage tank is at the rear capable of holding enough fuel for 20 hours' operation. For use with a ¾-yd. bucket a 30-ft. boom of braced steel is furnished, or a 38-ft. boom for a ½-yd. bucket, drag line or clamshell.

All operating levers are placed so that they can be handled conveniently by one operator on the right side. This new crane is known as No. 206.

Austin Machinery Corporation of Louisiana

The Austin Machinery Corporation of Louisiana has been incorporated with a capital of $300,000 and will act as distributor of the products of the Austin Machinery Corporation for the states of Louisiana, Arkansas, Mississippi and Tennessee. The offices of the new firm are at 1020 Maison Blanche Bldg., New Orleans.

Lakewood Clamshell Buckets

An illustrated 16-page booklet describing the use of Lakewood clamshell buckets on various types of cranes has recently been issued. Very little printed text is in the booklet, the greater part of the space being devoted to pictures illustrating the use of Lakewood buckets under various conditions and with various kinds of material.

Resurfacing Worn Pavements

An illustrated booklet describing the resurfacing of worn pavements with asphalt and bearing the title "New Pavements at Half the Cost," has recently been issued by the Barber Asphalt Paving Co., Philadelphia, Pa. A number of cases of worn brick, macadam and concrete pavements that have been brought back to usefulness by the use of Barber asphalt are illustrated. Since 1912 Columbus, O., has resurfaced 17 streets with asphalt with no maintenance expense since resurfacing.

Portland Cement Production in 1920

In the production, shipment and gross value of Portland cement, 1920 was a record year, according to estimates prepared by the U. S. Geological Survey.

The production is estimated at 100,302,000 bbl., and the shipments at 96,329,000 bbl., valued at $193,548,000, compared with 80,769,378 bbl. manufactured and 85,596,616 bbl., valued at $146,656,076 shipped in 1919. This is an increase of 24% in production, 13% in shipments and 31.9% in value of shipments. The stocks of finished cement increased from 5,852,479 bbl. at the end of 1919 to about 8,290,000 bbl. at the end of 1920, or more than 41%.

The average factory price in bulk at the mills for the whole country was $2.01 a barrel in 1920, compared with $1.71 in 1919, an increase of 17.5%.

New Non-Freezing Explosive

An explosive which cannot freeze or cause headaches has recently been brought out by the Atlas Powder Co., Philadelpha, Pa. This explosive is manufactured in five grades and requires a No. 6 blasting cap to detonate it. Because unaffected by climatic conditions, this new explosive possesses many advantages over the ordinary nitroglycerine powders and should find wide application in road building and similar work.

The Portland, Ore., office of Warren Brothers Company is now located in the Pacific Bridge Bldg. in that city.

PUBLICATIONS

CITY OF NEWPORT, RHODE ISLAND. Annual Report of the Street and Highway Department, 1919. Paper, 6x9 in., 68 pages.

Contained in this report are detailed statistical statements relative to the operation of the Newport Street and Highway Department during 1919. A total of $249,241.28 was expended during this year, which amount includes items of street cleaning, snow removal, sewer work, etc. Nepport has 92.27 mi. of streets, most of which are of macadam construction.

STATE OF NEVADA. Biennial Report of the Department of Highways, 1919-1920. Paper, 6x9 in., 144 pages. Illustrated.

During the two years covered by this report Nevada spent $2,181,350.47 on highway work. In this period 144.08 mi. of highway and 6 bridges were built, with 8 contracts for 39.55 mi. of road and 2 bridges under way at the time the report was written. Considerable attention is given by the report to the increased cost of road construction. Following the general discussion of the operations of the department, the second half of the report takes up the work by counties.

WYOMING STATE HIGHWAY COMMISSION. Second Biennial Report, 1919-1920. Paper, 6x9 in., 122 pages. Illustrated.

A total of $3,603,457.67 was spent on road construction and maintenance in Wyoming from March 1, 1919 to Sept. 30, 1920. Of this amount $2,718,700 was spent on construction and $304,262 on maintenance. Surveys were made on 1,958.5 mi. of highways at a cost of $168,992. Approximately 1,615 mi. of road were under maintenance, and construction included 229.6 mi. of federal aid roads completed, 341.9 mi. of federal aid roads started and 486 mi. of roads rebuilt with state equipment, making a total of 1,057.5 mi. under construction.

STATE OF NEW YORK. Report of the State Commissioner of Highways, 1919. Cloth, 6x9 in., 561 pages.

During the year 1919 the department awarded contracts for work on 1,391 mi. of highways, involving the expenditure of $22,912,500. Twenty-three per cent. of the staff left the department during the year and because of this fact an increased salary scale for engineers was approved and put into effect. A new policy was introduced by publishing in the fall of 1919 advance notice of work to be done in 1920 so as to let contracts in the winter months, thus permitting contractors to start work early in the season.

——ooo——

Road Building in Alaska

(Concluded from page 136)

A railroad must have large tonnage, and trunk-line railroads, such as proposed for Alaska, cannot hope to succeed except as they become arteries of trade supplying large areas. Such areas must extend some distance from the railroad line and terminals, and they can be made tributary thereto only by means of branches. In a highly developed country the larger of these branches may be small railroads or even small systems, but the last connecting link between the railroad and its customers, the mine, the farm, and the factory, is a wagon or a truck.

Great natural riches can make a country productive even without the assistance of roads, as Alaska proved before 1906. Since that time, however, the evidence of the value of the few existing roads has been demonstrated, and the necessity of completing the road system has been made manifest.

If left to itself Alaska will continue its slow rate of development, and by building its own roads and creating industries sufficient to warrant private enterprise, it will, in half a century become an empire in spite of all hindrance. No rapid or general development has followed, or will follow, the construction of the Government trunk line railroad to the interior unless preceded or accompanied by the construction of numerous wagon roads and trails as feeders. By the construction of highways as the development of the country demands them, this period may be shortened to one-half. The railroads and highways should shorten it to one-quarter. The experience of Alaskan railroads already constructed is a strong indication that without road systems no Alaskan railroad need be expected either greatly to stimulate the development so much to be desired, or to be anything but a financial failure itself.

MEETINGS

Calendar of Coming Meetings

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 23-26—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

PERSONAL MENTION

T. Owens has been appointed city engineer of Port Angeles, Wash.

L. E. Sneary has been appointed city engineer of East Moline, Ill.

W. O. Lloyd has resigned as road supervisor of Lee County, Arkansas.

Samuel H. Garvin has been appointed city engineer of Bowling Green, Ky.

R. F. McDowell has been appointed county engineer of Cuyahoga County, Ohio.

Murphy Brown has been appointed road supervisor of Lee County, Arkansas.

Allen J. Saville has been appointed commissioner of public works of Richmond, Va.

L. C. Boone has been appointed county engineer of Orangeburg County, South Carolina.

N. A. Eckart was recently appointed chief assistant city engineer of San Francisco, Cal.

George J. Banton has been appointed New York district manager of the Chain Belt Co.

Fred Voyles has been appointed county highway commissioner of York County, Nebraska.

S. E. Fitch has been appointed a division engineer of the New York State Highway Department.

William J. Shea has been appointed construction engineer of the Bureau of Highways, Brooklyn, N. Y.

A. J. Cleary, has resigned as chief assistant engineer of San Francisco, Cal., to enter private practice.

Charles Van Amburgh, Third Deputy Commissioner of the New York State Highway Department, has resigned.

C. B. Smith, Editor of the "Professional Engineer," has resigned to do publicity work for the Chicago Bridge and Iron Works.

E. S. Greene, formerly State Highway Commissioner of New York has opened an office as consulting engineer in New York City.

Alexander Murdock, formerly chief adjuster of the U. S. Emergency Fleet Corporation, has been appointed city engineer of Chicago, Ill.

Burr H. Thompson, District Engineer of the Portland Cement Association, has resigned to become salesman for the Kentucky Rock Asphalt Co.

S. J. Williams and F. P. Joyce, engineers formerly in the employ of Marion County, Indiana, have entered private practice, with offices at Indianapolis.

William B. Reed, since 1910 a district supervisor of the New York State Highway Department, has been appointed Third Deputy Commissioner of Highways.

A. R. Hirst, Chief Engineer of the Wisconsin State Highway Department, has tendered his resignation to take effect not later than the close of this year, stating that he is unwilling to continue with an underpaid staff.

OBITUARY

James J. Fisher, from 1903 to 1909 City Engineer of Williamsport, Pa., died Feb. 5 at his home in Muncie, Ind.

Charles W. Reid, Manager of the Transportation Bureau of the Federal Highway Council, died at his home at Clarendon, Va., on Jan. 30.

John Wilcox Pratt, Vice President and Secretary of the Wiard Plow Co., died on Feb. 3. Mr. Pratt had been connected with the Wiard Company for 43 years.

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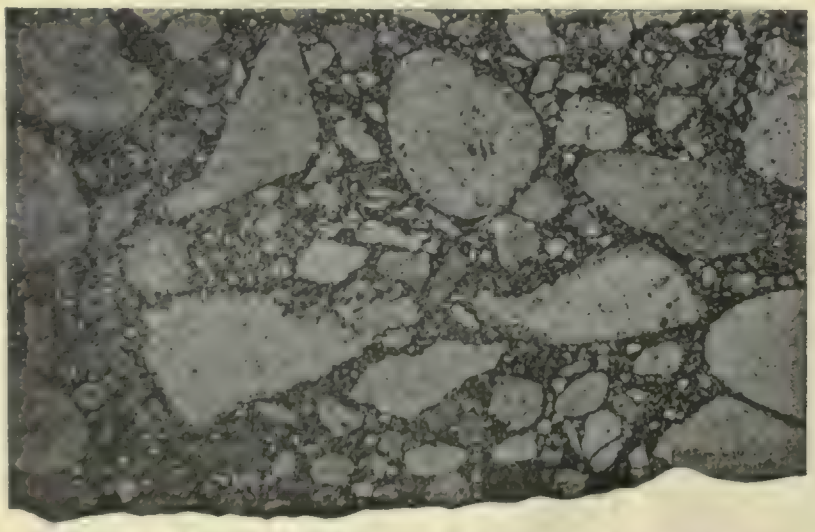

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Bridge Work in Wyoming

By J. F. SEILER*

The work of bridge construction in the State of Wyoming is of particular interest and importance because several factors affecting the design of structures, which do not call for special study in the more fully settled and flatter states of the East, here demand the most careful consideration. For example, while the annual rainfall in this state is very light, cloudbursts of the greatest intensity occur from time to time, with the result that streams or draws which are dry for eleven months in the year carry enormous flooods for very short periods. Numerous irrigation works also affect the flow of our streams to a considerable extent. The disposition of materials further affects the design in a number of cases, as do also the extremely long distances from railroad shipping points, which in some instances increase the cost of concrete work from five to eight times that in other localities.

The Bridge Department in its work of designing structures for the various highways which are being constructed in this state, keeps in mind two things—permanence and economy. In considering the first, particularly with reference to structures of concrete or reinforced concrete, the design is made on the assumption that the structure is to serve not for a period of 10, 20 or 50 years, but for all time. In working on this assumption, there are at least three important elements to consider:

First, waterway required; ;second, provision for maximum loads which the future may bring, and third, protection for any part o fthe structure subjected to wear.

In a comparatively new state like Wyoming, where data on the flow of streams are more or less limited, the first element in connection with waterway required, offers by all means the most difficult problem of the whole design, but this problem is met in the best way possible, by a study of the drainage area, character of soil and slopes, and elevations of high water marks. For the latter, dependence has to be placed largely on the statements of the oldest settlers in the community, and it is readily appreciated by one who has had experience along these lines

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*Bridge Engineer of Wyoming.

NORTH PLATTE RIVER BRIDGE, CASPER, WYO.
TEN 40-FT. BEAM SPANS

CASPER CREEK BRIDGE AT CASPER, WYO.
CONTINUOUS T-GIRDER CONSTRUCTION

that very frequently the information thus obtained proves to be of little value.

If, in the design, sufficient waterway is secured to care for the extremes of flood, the structure may be considered safe from a standpoint of foundation security, provided, of course, that ordinary practice as to stability has been followed. If the waterway adopted proves to be inadequate, and if the roadway fills resist the flood tide, then naturally there is a great increase of head at the restricted opening, with a consequent velocity increase. This increased velocity results in scour of the stream bed and this scour continues until the area of waterway is increased sufficiently to reduce the velocity to a point where scour ceases. Now, if the foundations have been properly designed for stability, and are carried below the plane of maximum scour, the structure will stand; if not, failure is likely.

In considering the second element entering into the permanence of the structure, i. e., maximum loads which the future may bring, it is the practice of this department to consider a concentrated load of 15 tons, or a uniformly distributed load of 110 lb. per square foot, with allowances, in general, of 25% additional for stresses developed by impact. Thus it is seen that provision is made for a load of about half the capacity of the average railroad freight car. On all but the shortest spans, the uniform loading usually governs, and since this loading is caused only by a closely packed crowd of people, or a herd of cattle passing over the structure, it would seem that the future could not bring forth any increase in such loadings. As to great increases in concentrated loadings, it is the firm belief of the department that no economy can result from the introduction of heavier motor vehicles or trucks than are in use at the present time; that increase in tonnage hauled will be accomplished by the use of trailers, and that the uniform loading designed for will be ample to provide for such traffic; and finally that the tendency toward the use of pneumatic tires and better and smoother bridge approaches and bridge floors will further reduce impact stresses, so that present load allowances will perhaps be even more liberal for future traffic than now. Nevertheless, in localities of especially heavy traffic, provision is even made for loading of 20 tons and 125 lb. per square foot, with the same allowance for impact. Thus it would appear that the permanence of the structure is assured in this respect.

POISON CREEK BRIDGE AT SHOSHONI, WYO.
THREE 40-FT. BEAM SPANS

In considering the third element, that of wear on the structure, provision is made to maintain on all bridge floors, a so-called wearing surface. This surface is generally either an asphaltic surface or one of selected material, composed usually of a mixture of clay, loam and gravel. In the former case the surfacing is applied to a depth of from 1½ to 2 in., and in the latter, from 3 to 4 in. In either case it is possible to maintain this wearing surface at all times, thus preserving the concrete surface from any wear. The asphaltic surface is, of course, preferable to the dirt surface, since the latter may become more or less displaced and expose the surface of the concrete.

The features insuring permanency in a structure having been considered, the second important feature of the design is economy. While the use of reinforced concrete is still in its infancy and its action in many ways is not fully understood, yet the theories advanced thus far and substantiated by experiment allow the designer much opportunity to practice economy. In the design of a bridge superstructure, most every item to be considered can be reduced to the case of a beam—a beam to be constructed of steel and concrete—to withstand certain stresses. Various combinations of steel and concrete will give the strength of beam required, and the problem is to proportion these materials in such a way that the cost of the whole is a minimum. A correct proportioning to secure this result depends upon the relative cost of the materials, and this relation may change from time to time and be greatly affected by the location of the structure. As an example of the foregoing, the writer some time ago took up a plan of a small bridge and found that by adding a small amount of concrete to the depth of the beams and eliminating a portion of the steel, so that the resulting strength of the beam remained the same as before, a saving in cost of $600 in the bridge was effected in this one particular. Hence, in the design of large bridges, vast amounts of money may be saved or wasted, depending upon the care which is exercised by the designer in preparing the plans.

During the two seasons past, the Highway Department has constructed a total of 89 bridges; 67 being of reinforced concrete, 11 of wood, and 11 of steel. These bridges are all of spans over 20 ft.,

(Concluded on page 152)

Importance of Drainage in Road Construction*

By F. H. ENO†

The writer realizes at the very beginning of this paper that he has been assigned a subject that has been worn threadbare in many written articles, textbooks and road conventions. Yet he ventures to assert that not many of the road builders present will deny the statement that considerably more than half of the road failures occurring today are directly or indirectly the result of defective drainage. If this is conceded, then some additional emphasis placed upon drainage will not come amiss.

The usual formula adopted in road drainage discussion is that road drainage like "all Gaul is divided into three parts" or divisions—cross surface, longitudinal or side surface, and subdrainage. Will you, therefore, pardon the writer if he unconsciously stumbles occasionally into some of those ditches? Under normal topographical and soil conditions such provisions would undoubtedly secure the desired results. Unhappily for the road engineer, nature is never normal as he encounters her, but she is invariably presenting to him a new variety of conditions.

Under present day road construction practice there is seldom a paved road that does not provide perfect cross drainage, at least from the center of the road to the edge of the paved way. Beyond that point perfection in drainage is difficult of attainment.

Unprotected Earth Shoulders

Following the usual specifications, the road builder finishes his road, smoothly grades the shoulders and berms, cleans and shapes the ditches, and leaves his completed roadway in good order. While in this condition water will run over the surface to the ditch and down the ditches to the outlets with the least possible resistance. Occasionally the plans call for rolled stone or gravel shoulders 2 or 3 ft. wide on either side of the pavement, to permit passing vehicles to leave the pavement and gain it again after passing. Probably 75% of the mileage of paved roads does not have this provision. From the road to the ditch nothing but the original soil intervenes between the unwilling trespasser and the unknown depths.

Two loads of hay cannot easily pass on a 16-ft. pavement. The speeding automobile when meeting a heavy truck must invariably leave the pavement on a 14-ft. roadway, usually upon a 16-ft. pavement and many times even when passing on an 18-ft. paved way. Truck drivers, knowing that the weight of their truck commands respect, are not very respectful themselves of the rights of others when it comes to permitting them to pass.

Picture the aforesaid newly finished road, spick and span, a delight to the eye of the engineer. Two weeks have passed. The road has been inspected by the division engineer and approved, with high praise for its excellent appearance. A three or four days' rain has wept itself out on the shoulders of the road. Two heavy trucks, or two great loads of hay meet on the road, turn out to pass and each runs a wheel out onto the rain soaked shoulders. Two ruts are formed and transverse drainage is ruined. Water stands in these ruts for days, penetrating deeper and wider, until the subgrade is thoroughly softened and almost uselelss as a support for the road and its traffic.

Ordinary maintenance will not save this trouble. The ruts are filled, and a half hour later the same thing happens again. With daily maintenance—an unheard of thing in America—it is probable that the rut will be there 23 out of 24 hours in the day. Which is the most economical, therefore, filling the ruts each day, repairing or rebuilding the road frequently, or building extension shoulders upon the road at the beginning?

The Dust-Filled Grass Shoulder

Another interference with perfect cross drainage is the gradual elevation of the outer shoulder, due to the grass and weeds growing up and being filled with dust and debris thrown and blown from the traveled way. Frequent scraping with the road grader and the complete removal of the vegetable matter and accumulated dust is the remedy. But how often is this done? Not until after the retained water has penetrated the shoulder and the damage has been done. Possibly a thorough treatment of the entire shoulder and ditch with oil might serve two purposes, waterproof the surfaces and prevent the growth of vegetation. It is true that in many places the unsightliness of this method would be seriously objectionable.

The Uncleaned Ditch

The appearance of a smoothly kept oil shoulder and ditch would be far more pleasing than the unkept tangle of weeds usually found in the roadside ditch. More important than appearance is the life and value of the road. The lack of proper maintenance practically annuls the usefulness of the ditch. In the long run it would be much more economical to construct ample subdrainage, provide frequent inlets, and grade the roadside ditch into a smooth depression over which a mowing machine could be run. In Ohio the greater portion of the money expended upon maintenance has been upon the shoulders and ditches of the highways, rather than upon the pavement. With the usual form of ditch the grass and weed cutting along the road must be largely or entirely hand work. Undoubtedly there are places along many roads where a deep ditch is necessary, but wherever light soils are encountered, or the topography will permit, the ditch should become a slight depression gathering the water to inlets into the drainage system below.

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*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Professor of Engineering, Ohio State University.

Subgrade Requirements

In order to fully appreciate the importance of drainage in road construction, it may be well to briefly state the requirements of the subgrade. The subgrade must be dry and stable. It must support the road and its traffic load without yielding. If yielding takes place with any monolithic type of road, flexure occurs and in a very short time definite breaks result. In the case of bituminous and other flexible forms, the continuous pounding of the subgrade in the presence of water soon churns the soil and water into a mush which has no supporting power and the road is quickly cut to pieces. How much deflection of the road, or deformation of the subgrade, can take place without damaging the road surface? Practically none with the monolithic type of road and but the most infinitesimal fraction of an inch with macadam and bituminous bound roads. A perfectly stable and dry, well compacted soil is necessary, therefore, to support roads subjected to heavy traffic. Once having yielded to the load, even 1/16 in., each impact thereafter increases the deformation going on. If water is present the deformation is multiplied rapidly.

Many roadbeds are cut into impervious clay soils; for this reason the subgrade should be given a slight crown to carry any seeping water toward the outside drainage. Provisions should be made so that this water can readily reach the subdrains. The fact that the subgrade is usually trench construction emphasizes the need of the above provisions.

Rolling

Engineers recognize the necessity of securing a well compacted subgrade. They do not always agree as to the best method of securing it. The question of treating all soils alike needs careful consideration. Undoubtedly, porous, well drained soils can be thoroughly rolled to advantage. Where rolling may be questioned is upon dense clay subgrades. It has been the custom in the past to write but one specification for rolling the subgrade, no matter what character of soil might be encountered. There are a great many varieties of soil in the country. Many times several of these will be grouped in a very limited area. This is especially true in hilly and rolling sections. In Ohio it is not unusual to find three or four kinds of soil exposed in 1,000 ft. of subgrade. The road builder should give careful consideration to this condition if he is to economically accomplish the result he plans to secure.

The farmer has known for years that by rolling the ground in dry weather he can help raise sufficient moisture from beneath to germinate his seed. Prof. F. H. King, of the University of Wisconsin, in the 7th annual report of the Agricultural Experiment Station, 1890, states: "Rolling soil increases its power for drawing water to the surface from below, this influence extending to 3 to 4 ft. in depth." This suggests that possibly there are soils and weather condition where and when rolling the subgrade should be reduced or eliminated entirely. It suggests the need for a thorough study of capillarity in soils and the effect capillarity may have upon the stability of road subgrades.

Capillarity

Capillarity has been studied by the agriculturist and the physicist, but so far as the writen knows no study has been given the subject by the road engineer. Prof. Milton Whitney, Chief of the Bureau of Soils, U. S. Department of Agriculture, says regarding the circulation of water in soils (see Maryland Agricultural Report for 1891): "Two forces move water in soils, gravity and the surface tension of the water." He also states that the rate of movement will depend upon: (1) How much space there is in the soil; (2) How this space is divided up; (3) The arrangement of the grains of sand and clay.

He further states that manure, fertilizers, lime and other chemicals change the surface tension of water; affect the arrangement of soil grains, causing flocculation or the drawing together of the extremely fine soil grains, thus changing the texture of the soil and appreciably affecting capillary movement. Prof. Whitney states that the grains in 1 cu. ft. of soil have not less than 50,000 sq. ft. of surface; that in clay soils considerably more than half the volume is open space. He estimated from analyses made of certain Maryland soils that a gram of what is termed Pine Barrens soil contained 1,692,000,000 grains, while a better class of soil known as River Terrace soil—a good wheat land—contained 11,684,000,000 grains. In this latter case he estimated the particles in 1 cu. ft. of soil would have 106,000 sq. ft. of surface, or about 2.3 acres area. This is just a hint of the infinitesimal size of the clay grains and the smallness of the channels that must exist between them. It is in these small channels that the skin tension of water gains its power to draw water for long distances. It has been stated that with some fine grained soils water can be drawn 8 ft. by capillarity. As the soil becomes coarser grained, capillarity decreases until in gravels it practically looses its power.

Prof. King explains an experiment upon horizontal capillarity where he secured a rate of flow of 2⅜ lb. of water per day per square foot of surface. From the brief review of the work done by the investigators of the Agricultural Department, it is quite evident that it will be very important for road builders and those engaged in research work to make exhaustive studies of capillarity in all its varying phases in order to be able to treat subdrainage in an intelligent manner. It is evident that tile drains placed 2 or 3 ft. beneath the side ditches will have little effect upon the amount of capillary water reaching the subgrade of the road, if the soil is fine grained and rests upon a water bearing stratum 4 or 5 ft. below. This suggests the question: Which are more desirable, tile drains beneath the center of the road or tile drains beneath the side ditches?

The Action of Soils in the Presence of Water

Slaking.—What is known as the slaking value of clay will give a hint as to how clay will act while absorbing water. Some clays absorb water rapidly, falling to pieces in a minute or less; others take hours; while an occasional clay will stand sharp-edged in water for weeks, apparently unaffected Some clays disintegrate into slimy slurries; others into powdery appearing masses; some into chunks, and still others into flakes. While making the slaking tests it was noted that a variation in the water content of the clay cylinder at the time it was plunged into the water bath, greatly affected the rate of slaking. Evidently the condition of the soil at the time of a long continued rain storm, or of a substratum of clay at the time of the spring thaw, may variously affect the final result as to whether great harm or small harm is done to a paved road.

Saturation—Different soils act differently in the presence of water. All of them, with the exception of sand, are made less stable when partially or totally saturated with water. The stability of some soils increases with the water content up to a certain degree of saturation and thereafter rapidly decreases as the degree of saturation continues to increase. Soils vary in their capacity for saturation. Tests now being carried on in the road laboratory of the Ohio State University Experiment Station show some remarkable differences in this respect. One yellow clay that absorbs water readily will hold but 28% of its weight of water, while another yellow clay which absorbs slowly holds 59%. A grayish clay soil holds 57%, while two black muck soils hold respectively 38% and 170% of water.

The amount of water a clay soil will absorb and the way it disintegrates in its presence, when thoroughly studied, is going to explain many unsuccessful attempts to secure permanent roads. Here again is a suggestion that some water-proofing method of treating the soil may be better than any form of under drainage.

Road No. 12 in northern Ohio is a splendid illustration of some of these peculiar actions of soil and water when brought into contact. It was built by a very competent engineer, who spared no pains in trying to produce a perfect road. The road has a 2-in. asphaltic bound surface upon a 7-in. concrete base. The side ditches are brick paved and located 5 ft. from the edge of the road. Tile drains are laid 2 or 3 ft. beneath the ditches on both sides of the road. Within three years spots along this road were badly broken, while long stretches were as good as new. The breaks occurred at the brows of hills in cuts. Invariably a dense clay stratum outcropped in the subgrade at the point of failure. At these points the ditches and the drain tile had heavy grades and shed water readily—apparently the very best of drainage conditions—and yet the road failed.

It is not probable that the broken spots were due to excessively heavy traffic, solely, for the same traffic which destroyed the pavement upon these clay outcrops should have destroyed it at other points if the bearing powers of the soils were equal. These clays, when reasonably dry, practically have as high a bearing power as any other soil, but when saturated they have little. Evidently those clay outcrops became saturated and while thus water filled were so reduced in bearing power that the failures occurred. According to what was then considered the best engineering practice, those subgrades should have remained dry, for roof drainage, ditch drainage and tile underdrains were perfect. What occurred? Evidently one of these things happened:

1. Water may have seeped into the subgrade from ruts along the roadside. (No such ruts were in evidence.)
2. Water may have percolated through the porous top soil on the hill top, penetrated to the impervious stratum, passing several feet below the tile drains, and, following the impervious clay between the lines of tile, reached the subgrade at the outcrop.
3. The impervious clay stratum may have rested upon a water bearing soil and by capillarity raised sufficient water to do the damage.

Natural Soil Drainage

How does Nature drain soils? Is it possible for engineers to utilize Nature's methods to advantage? If an intelligent answer could be found to these questions the road engineer might be greatly helped. D. S. Humphrey of Cleveland, a member of the State Highway Advisory Board of Ohio, claims very emphatically, that most of the highway engineers, in their present practice, are making a serious mistake in cutting through the top soil for their subgrades. He says that if instead of quibbling about grades they would build their road foundation on top of the top soil, largely disregarding the grades, they would get very much better support for their roads and at the same time secure better drainage facilities. He believes that the more organic matter the top soil contains the better subgrades it will make. That surface soil is almost invariably more porous than sub-soil no one who has examined soils will deny.

If the top soil is analyzed with reference to its drainage facilities, note: (1) That roots of trees and vegetation have penetrated deeply into it and with the death and decay of these roots, it has been left full of drainage channels; (2) that worms, insects and animals have burrowed through it; (3) that frost has raised it and expanded the pore spaces in it; (4) that percolating waters have leached away many salts, until a well developed and intricate drainage system has been naturally provided.

It is true that outlets must be found for these minute channels, but usually the natural slope provides them. One channel always remains open and that is evaporation. Evaporation is vastly more effective on the surface of the ground than it is in a clay cut. One point that should be stressed in Mr. Humphrey's argument for placing roads on top of the soil is the fact that greater opportunity for leading surface water away through culverts is provided. It also permits much shallower ditches and more fall to the outlets. A survey of hundreds of road failures in cuts has shown that the top stratum of soil was the most porous and that the porosity decreased as the depth from the surface increased. Hence the water which was accepted more or less freely at the surface was gradually retarded in its flow deeper down permitting saturation to occur in the denser soils, while the soils near the surface were not so completely saturated. This at least argues for less trouble with mushy soils the nearer the roadbed lies to the surface of the ground.

Center Cracks

In the survey of road failures in Ohio one form of failure has been very frequent and baffling, namely, longitudinal center cracks. One cannot travel over brick or concrete roads anywhere in that state without seeing mile after mile of longitudinal center cracks. Undoubtedly water, frost and traffic are the three responsible agents, with water at the bottom of all of it, but how to prevent the trouble has not yet been solved. The possible combinations of these three criminals are numerous:

1. The road, having been built upon a solid subgrade, may have had water penetrate beneath its edges from ruts alongside. This softened the soil along the edges of the road so that heavy traffic upon the road broke it over a hard unyielding center ridge.

2. Under the above condition, a quick sharp cold wave may have frozen the earth along the edges of the road before the frost could penetrate the pavement sufficiently to freeze beneath the center of the road. The result would be to raise the whole road slab, leaving it supported at the outside edges only. Heavy traffic would then break it down in the center.

3. The whole subgrade may have become saturated and then frozen solid. The spring thaws then may have thawed out the soil more rapidly on the shoulders and edges of the road than it could through the pavement and the road has been broken down over a solidly frozen ridge beneath its center line.

4. The whole subgrade may have become saturated and then frozen solid. A warm wave then thawed everything down to about 8 in. or more below the subgrade. A sudden cold wave then froze the outside soil down to the main bed of the frozen soil once more, leaving a mass of water sealed beneath the center of the road. Continued cold finally froze the inclosed water and in its expansion the center of the road was raised and cracked.

5. The road was laid upon a dense, dry clay subgrade which had been well rolled. The rolling or rise in the ground water caused the subgrade soil to fill by capillarity. Clay swells when it absorbs water and the center of the road was raised and a crack resulted. The same capillarity acts across the whole subgrade width, but evaporation reduces the water content and the consequent swelling at the side of the road.

Further cases might be given, but these serve to indicate the great need of perfect drainage to such a depth that neither vertical nor horizontal capillarity may act. The conditions just enumerated again suggest that not only must drainage be deep enough to prevent the ground water rising to within capillary striking distance of the subgrade, but that probably some form of water-proofing may also be necessary to prevent water from the ditches and ruts on the shoulders being conveyed to the subgrade.

Swelling Soil

The writer is informed that in Illinois the Highway Department treats the subgrade with water before the foundation of the road is laid. The intention evidently is two-fold, namely, to cause the soil to swell as much as it will before the foundation is laid upon it, and to prevent a dry soil from withdrawing water from the concrete to the detriment of the foundation. That some soils swell and shrink in the presence and absence of water, respectively, is very well known by one who has lived near a clay basin. The adobe lands of the West will show many criss-cross cracks, some of them 3 or 4 in. in width, during the dry season. These are entirely closed soon after the wet season begins.

Prof. King says, in the report previously mentioned, that water added to the top of soil will draw

(Continued on page 153)

The Concrete Road System of Wayne County*

By EDWARD N. HINES†

Since 1906, when by a referendum vote of 7 to 1 the county road system was adopted, great changes have taken place in Wayne County. From a population of 531,591 and an assessed valuation of $417,070,750 the county has grown numerically to a population of 1,177,645 and the assessed valuation has increased to $2,134,937,967. In 1906 there was not a mile of improved road nor a paved village street in the entire county; motor trucks were hardly known, the Packard Company having built 59 trucks in 1905 and discontinued their manufacture until 1909. The first appropriation for improved roads aggregated $85,000 and the Board of Supervisors, who control the expenditure of the county road fund, directed that this money should be expended on 14 different roads. The Board of County Commissioners was opposed to this uneconomical method of investing road funds. In an attempt to forecast the future, and in order to realize the greatest good to the greatest number, the board laid out a definite, systematic, continuing plan covering a period of years towards which to work as funds became available. It speaks well for the vision of the board that after a lapse of 15 years we are still working on the plan laid out in 1906 and that practically no changes have been made up to the present.

Outside of the incorporated cities and villages in Wayne County there are approximately 1,370 mi. of public wagon roads.

Experience has shown that 80% of the traffic uses about 25% of the mileage, and in planning for the future it has been the thought of our board to build 350 mi. of concrete road, so that in a general way, when this program is completed, no section of Wayne County will be more than 3 mi. east, west, north, or south from a first-class concrete road.

The main roads radiating from the City of Detroit to the county line, such as Jefferson, Mack, Van Dyke, Mt. Elliott, Gratiot, Woodward, Grand River, Plymouth, Michigan, Fort, and River Roads were first adopted as county roads and completed.

The connecting up of the villages and cities in the county, one with the other, was the second step in the plan, which is also largely completed.

Our third step calls for the encircling of the county with three belt lines—an outer belt, an inner belt, and a middle belt route.

The outer belt route has been completed, and a good start has been made on both the inner and middle belt routes.

The fourth step contempletes the paralleling of the main routes of travel out of the City of Detroit and the widening out of those already built. This latter feature of our plan is being carried forward at the present time.

Intense Traffic on Our Roads

Traffic counts were recently made on Woodward Avenue, Gratiot, Grand River, Michigan, River and Van Dyke Roads, just outside of the city limits.

On Woodward Avenue we counted in excess of 14,000 vehicles for a 14-hour day; the average for the week ran greater than 10,500 per day.

These vehicles are being carried on a comparatively narrow concrete road, 18 ft., with a 3-ft. bituminous shoulder on each side, so that the traffic is very intense for this width of pavement.

The accompanying table is interesting in that it shows the great increase in traffic during the past eight years.

Road	1912		24-Hour Count	
	Horse-drawn	Auto. touring	Trucks	Total
Woodward	322	2,146	122	2,590
Gratiot	732	437	40	1,209
Grand River	471	528	53	1,082
Michigan	364	549	23	936
River	125	370	13	508
Van Dyke	389	209	20	618
	1920		14-Hour Count	
Woodward	90	9,440	1,007	10,537
Gratiot	46	3,203	315	3,564
Grand River	32	2,040	486	2.558
Michigan	17	1,979	613	2,609
River	33	1,619	329	1,981
Van Dyke	102	1,402	590	2,094
	Comparison	1912—1920		
	Decrease (Times)	Increase (Times)	Increase (Times)	Increase (Times)
Woodward	3.6	4.4	8.3	4.1
Gratiot	15.9	7.3	7.9	3.0
Grand River	14.7	3.9	9.2	2.4
Michigan	20.8	3.6	26.6	2.8
River	3.8	4.4	25.3	3.9
Van Dyke	3.8	6.7	29.5	3.4

Our 1912 report published traffic records for the various thoroughfares leading out of Detroit which we have reproduced in the table.

We also show traffic records in 1920 at the same point on the same road.

Horse-drawn traffic has decreased from 3.6 times on Woodward Avenue to 20.8 times on Michigan; while automobiles have increased from 4 to 7 times; trucks having increased from 8 times on Woodward Avenue to 29 times as many trucks on Van Dyke today as there were in 1912.

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*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Chairman, Board of County Road Commissioners, Wayne County, Michigan.

The total average increase in all traffic runs from 2 to 4 times what it was in 1912. It is interesting to note that in 1912 on Michigan Avenue Road there were 364 horse-drawn vehicles per day, while in 1920 only 17 horse-drawn vehicles were found in a day. These figures are average for a week's count.

With this tremendous growth in traffic, particularly with regard to the use of the motor trucks, we are doing additional planning to adequately prepare for the future.

A comprehensive survey has been made of the entire county and 7 heavy-duty radial roads with a right of way of not less than 100 ft. have been laid out to the county line in various directions to provide primarily for truck traffic of the future. These roads will be bee-line roads, built of concrete, free from grades, with a width of metal of not less than 36 ft.

At the present time the width from fence to fence of a legal road in Michigan is 66 ft. and in order to make our planning effective at once the Board of County Auditors of Wayne County has signified its intention of not permitting any plats to be laid out and accepted through which the heavy-duty arteries will pass unless a 100-ft. right of way is dedicated for road purposes. Legislation will be sought at the present session of the Legislature to create regional planning commissions along the line of city plan commissions, naming the various county road commissioners as regional county commissioners with the state highway commissioner as the final arbiter, so that in case of disagreement over the necessity or desirability of these additional radial arteries there will be some authority whose decision will be final. Legislation will also be sought permitting roads to be condemned or laid out to a greater width than 66 ft. By following the foregoing procedure, at some date in the future these radial highways will become a fact without any great expense for right of way. After the completion of our present program we are planning to take over the more important township roads, giving them a proper alignment, grading, rebuilding bridges, putting in drainage, and arranging for systematic dragging and maintenance. As traffic increases on such townships roads over which we acquire jurisdiction we expect to gravel and eventually concrete them.

Since 1908 and 1909, when we designed and built our first concrete road, we have standardized and built practically our entire mileage of concrete. We believe there is greater value per dollar in concrete than in any other material. Comparative low first cost, ease of traction, freedom from dust and dirt, reasonable maintenance cost, durability, freedom from patents and royalties, non-slipperiness, capacity for resurfacing and widening with concrete in the case of the narrower roads, easy riding and availability of materials—have been the determining factors in our decision. We consider as quite well settled for present and reasonable future conditions the question of surfacing—as to design, construction and maintenance—and our effort is rather to foresee future needs. The minimum width of the concrete we have been building for the past five or six years is 18 ft. and wherever we can we are building to a width of 20 ft. We find that in the course of a few years the extra cost of maintenance on the shoulders of an 18-ft. concrete road will pay for the additional 2 ft. of concrete.

We are also building a considerable mileage of roads with a width of from 24 to 40 ft., these greater widths being near the limits of the City of Detroit.

Upon the general construction features of our work I am not going to dwell at length, as you are all familiar with good practice in concrete road construction. However, we are building our roads to a definite service, rather than building them down to a price. We use a rich mix; 1 minute in the drum with 16 revolutions; clean washed stone and sand; and 8-in. side-rail, making an average thickness of concrete of 9 in.; machine finish; dry-mixed concrete; curing two weeks with water and two weeks with air, a total of four weeks, which is the minimum time during which traffic is kept off our roads. We follow up all of our construction with continuous, adequate, and intelligent maintenance. Detours, well marked and maintained, are provided for traffic during construction.

We are providing on all bridges a minimum clear width of roadway of 24 ft. which will develop the full future width of roadway that may reasonably be expected. Sidewalks are being provided on bridges whenever the safety and convenience of the public require them. We are building our bridges strong enough to carry a 24-ton live load with a proper safety factor.

Looking towards the permanence of our bridge structures, it is our policy to build concrete rather than steel structures where conditions will permit. Wherever the banks are high enough and foundation conditions are suitable we build reinforced concrete arch bridges. Where the banks are not high enough and where short span lengths can be used we build reinforced concrete T-beam and slab bridges. Where the conditions call for spans too long for concrete T-beam construction or where arch bridges are not practical we resort to structural steel bridges of the pony truss type without overhead bracing. In all cases the particular bridge site is carefully studied and a type of bridge selected which embodies the maximum of durability and beauty that local conditions will permit.

Wherever it is possible, adequate and safe temporary bridges are built to carry roadway traffic while new bridges are under construction, it being our policy to provide detours and to cause the least possible inconvenience to the public during construction or maintenance work.

All of the roads under our jurisdiction are signboarded. We have adopted an ornamental reinforced concrete guide-post, 10 ft. high, set in a concrete foundation. The road signs are securely fastened to these concrete posts with metal brackets. The basis of distance is taken from the Campus in the City of Detroit. One wing of the sign gives the distance to the next town, the distance back to the heart of Detroit, and the distance to the termination of the route; for instance, on Michigan Avenue Road, to Chicago. The name of the road is also given. The side or cross-road wing of the sign gives the name of the towns or the route which is available to traffic to turn off from the main artery of travel. Where there is no important center to which the road leads, the name of the road alone is shown on the signboard. No advertising signs nor boards tacked on telephone posts or otherwise which are in the right of way of the road are allowed. Provision is also made to place electric lights on each post as soon as funds may be available, so that the traveling public may read the signs at night, as well as in the daytime.

Substantial guardrails, painted white, are erected to protect every dangerous curve, every deep ditch and every end of the road. Guard-rails are staggered at curves to provide visible warning of the approach. This work is now completed on our entire system and as rapidly as we complete a new road, the necessary guard-rail is erected as part of the construction cost.

When we first started the improvement of our roads, but little attention was paid to alignment, no funds being available for acquiring right of way to straighten out kinks, curves and right angle turns. At the present time, however, we are giving this subject a great deal of attention and correction; all curves are widened out and superelevated and every effort made to safeguard the public.

We regard safety as a sure principle in all design, including roadside planting.

Paved Railroad Crossings

Through cooperation with various railroad companies we are gradually improving all the grade crossings with Wayne County roads. Wooden crossing planks are so expensive and of such poor quality that the railroads themselves are glad to cooperate in using some material which will last longer.

Grade crossings have been built by us in the past, using the following methods:

First: Under light traffic railroads, street-car tracks and sidings, we have been digging out under the ties to a depth of 1 ft. below the bottom of the tie and filling in with a 1-ft. slab of concrete. Then new ties are placed and new deep rails spiked on. The job is completed by pouring concrete between the ties and over the ties to the top of rail, joining with our concrete pavement on either side and striking off level with the top of rail. Flangeway is provided either by allowing the car wheels to form their own flangeway or by placing a rail on its side against the inside of the main rail.

Second: One railroad has been progressive enough to allow us to experiment with one of its main double-track lines in putting in a pre-molded concrete slab crossing. These slabs are approximately 2x6 ft., with a depth the same as the depth of rail. We build them at Wayne in our tile yard and haul them out to the crossing and lay them in place of the common plank. If this type of crossing proves to be a success for highway traffic it will be very desirable, because it is possible for the section crew of the railroad to remove the slab, ballast up the tracks and replace it.

Third: The third type of crossing which we have used has been the same as the first, except that the surface has been filled in with special granite blocks along the inner side of the rail, thus providing a flangeway.

We have also started on a program of grade separation on important trunk line roads and three projects are under consideration at the present time.

Snow Removal

Since 1912 we have followed the policy of removing snow from all county roads as soon after the storm as possible. The county is divided into three zones, with a construction superintendent in charge of each. They are furnished with snowplows, scrapers, graders and shovels. Each superintendent inspects his zone or district all through the winter. He has lists of men who will turn out for road cleaning work and also lists of team owners.

As soon as the snow begins to fall or drift seriously we start our trucks and graders at work removing it from the concrete road. We find that it facilitates the work to not only remove the snow from the concrete, but continue to use the graders and plows to crowd it from the shoulders of the road to the side ditches, thereby giving a clear turnpike which will be free from drifting back.

This phase of our maintenance work is one that is very much appreciated by the public.

In the interest of safety we are painting white dividing lines on our concrete roads and we find that it has a decided tendency to keep the traffic on its own side of the road.

There are a number of other outstanding phases of a well organized road system that we regard as essential to safety, pleasure and comfort of road-users, on which we are making considerable progress. Despite the fact that we have no funds available for their accomplishment, we have been persistent propagandists for the adoption of such projects as roadside lighting, roadside planting and decoration, foot-walks for pedestrians, closed ditches, comfort stations, roadside parks, play and picnic grounds. Through our efforts, various communities in and around Wayne County have been convinced of the desirability of lighting the roads and in round figures about 45 mi. of road are now well lighted at no expense to the county. This feature has a tendency to encourage the shifting of part of the heavy motor truck traffic, especially the well organized truck lines, to travel at night and enables the traffic to proceed at greater speed, comfort and safety, free from the nuisance of glaring headlights. We are making slow but sure progress on this phase of our work. Footpaths or sidewalks are also needed, that pedestrians may be safeguarded along the heavily traveled roads, and progress is being made in this direction.

With 123,000 motor cars and trucks licensed in Wayne County and continuously using our roads for business and pleasure, public comfort stations are needed and a propaganda campaign through the medium of our annual reports and prepared press articles is being carried on. I regret to report that to date nothing definite has been accomplished, but we have hopes.

Some progress has been made in tree planting and roadside decoration, as well as in the establishment of a county park system. We have been urging public spirited, wealthy citizens to make donations of small tracts of land in and around our river and stream valleys for county park purposes.

Last year through the generosity of Elliot T. Nichols and his sisters, 159 acres of land, lying along the River Road and the Detroit River, have been dedicated to the public for use as a county park. This land has an assessed valuation of over $500,000 and a market value of over $800,000 and amply repays us for all our past activities and is a starting point for future gifts of this character.

Rural fire protection has also been given some thought and effort on our part. With motorized fire apparatus and the quite generally distributed water supply from streams throughout the county, it seems reasonable to suppose that well equipped township fire fighting organizations may be established, and, therefore, from the fact that through concrete pavement miles are reduced to minutes, dwellers along Wayne County's highways may be ultimately afforded a measure of protection against fire such as heretofore has been within reach only of the city dweller. This, of course, is looking to the future and will mean much planning and the necessary development of water supply well distributed where natural sources of supply are not now available.

Finance

A bond issue to the amount of $2,000,000 was voted in 1920 for the purpose of building two bascule bridges at a cost of $1,000,000 each and a bond issue was voted 11 years ago to be spent over a five-year period. The purpose was to provide a continuing plan and popularize the road improvement movement by providing sufficient visual evidence of the value of good roads to the community. Aside from these two bond issues we have followed the pay-as-you-go plan.

We have a number of available sources of revenue and for 1921 we have available the stupendous sum of over $2,300,000 exclusive of the $2,000,000 bond issue for specific bridges.

The limit of direct taxes that can be levied by law in Wayne County is ½ mill, based on the equalized assessed valuation of the preceding year and spread over the current year's levy. This tax is levied by the Board of Supervisors at their annual session in October and is not mandatory, it being within the power of this body to reject, change, alter, reduce, or make any disposition of our recommendations they see fit. By a unanimous vote of 90 supervisors a ½-mill road tax was levied in October, 1920, which will raise in round figures $870,000. We also receive from the state 50% of all moneys realized from the sale of automobile licenses, which will amount to about $1,000,000. We also earn state reward amounting to $7,500 a mile on roads built according to standards set by the State Highway Department.

Inasmuch as our concrete road specifications are stricter than those set by the state, we expect to realize from this source and from the state's contribution on bridges upwards of $300,000. Several communities through which our roads pass have turned over to us varying sums ranging from $38,000 to $45,000 with which to build additional width or make other road improvements. In addition thereto we have a federal aid project, 14 mi. long, all graded, with ditches and drainage structures awaiting surfacing with 20 ft. of concrete. We have a total of 37 mi. of road graded, with drainage structures in, and aggregate stock piled sufficient to surface 12 mi. with concrete of widths varying from 18 to 32 ft. With adequate transportation facilities we expect to have a record road building year.

In conclusion, I cannot refrain from giving my viewpoint as to how the public regards the concrete road system of Wayne County. The City of Detroit pays 80% of the county tax and has a two-thirds majority of the membership on the Board of Supervisors. Notwithstanding that no county road funds can be spent in the City of Detroit, the vote on levying county road taxes has usually been to the limit allowed by law, and always by unanimous vote. The outstanding results, which are visible to every traveler, have forced the recognition that road building as conducted by Wayne County is an investment and not an expense—an investment that saves time, trouble, annoyance and expense.

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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BRIDGE WORK IN WYOMING—AND ELSEWHERE

On other pages of this issue is a discussion of some of the more important factors entering into the work of bridge building in the state of Wyoming, written by the bridge engineers of the highway department of that state. Though of especial interest to bridge engineers because of the problems that have to be met in that particular locality, it directs attention to the general question of highway bridges—one of the most important facing the highway authorities of all of the states.

The bridge question is a vital one because upon its solution depends the utility of the road system. The conditions which exist form a serious obstacle to the maximum utilization of the highways of the country, which means that they are bars to the continued development of highway transportation. All over the country there are thousands of bridges that are not strong enough to carry modern truck traffic. Until these bridges are strengthened or replaced by adequate structures, the roads upon which they are located will be of only very limited use, no matter how well paved.

In most state work—which, theoretically at least, means the work on the most important through routes—the bridge work can be, and is, properly taken care of. This is not always the case in county and township work, largely because of the lack of funds. The building of adequate bridges is a costly undertaking in many sections, not only because of high labor and material costs, but also because of the number of structures and because they are scattered over so large a mileage of roads.

Bridges are parts of the road and they are more nearly "permanent" than are other parts of the work except the grading. That being the case, there is every justification for the use of the proceeds of long-term bond issues to defray the cost of their construction. Though paying by this method means a greater total cost, the urgency of the need justifies the greater cost and the service rendered would offset it in many, if not all, cases.

CARELESSLY DRAWN ROAD LAWS

Missouri cannot use the proceeds of motor vehicle license fees to pay interest on road bonds, according to a recent opinion by the attorney general of the state. The opinion is based on a point of law and serves as an illustration of the result of a too common fault in road legislation.

Many excellent highway laws have failed because of this fault. Road laws, like most others, frequently are prepared hurriedly, given scant consideration in legislatures and put on the statute books in a form that is unconstitutional or ineffective because of illegal provisions or provisions in direct conflict with those of other statutes.

The obvious remedy is the preparation of road bills by experts and their examination by legal authorities before, not after, they become laws. This course would avoid many needless delays in road work, much costly litigation and an enormous waste of money and effort.

MARKETING ROAD BONDS

St. Louis County, Missouri, has been unable to market its road bonds at the minimum price of 95 permitted by the state laws, the highest bid received being 88.60. As a result, the amount to be sold has been reduced from $280,000 to $180,000 and an effort is to be made to sell the bonds to the citizens of the county.

Other references have been made in this column to the difficulties experienced in marketing road bonds under the financial conditions that have obtained of late. The situation is the same all over the country and various measures for its alleviation have been proposed. The one to be tried in St. Louis County should meet with success.

The man who buys bonds solely for investment can not be expected to purchase those yielding only 3 or 4 or 5% when he can buy much better ones in the open market. On the other hand, any citizen can well afford to put his money into bonds issued to meet the cost of improving the roads in his own neighborhood.

Bridge Work in Wyoming

(Concluded from page 142)

and do not include a vast number of culverts and boxes which have been constructed. The reinforced concrete structures range from 20 to 450 ft. in length, and the steel from 32 to 650 ft. The principal rivers or streams over which the larger structures have been and are being built, are the North Platte, the Big Horn, the Green River, the Wind River and Snake River. The Yellowstone Highway, Wyom- Snake River. The Yellowstone Highway, Wyoming's principal artery leading to the Great National Park, crosses both of the first named rivers in several places and special designs for bridges at these crossings have been made up, embodying all the features mentioned. Several of these structures have already been constructed.

While the materials for many structures in the state are not available locally, and the great distances from railroad shipping points make extremely long hauls necessary in a number of cases, yet along the principal rivers and streams, such as those mentioned, the most perfect materials are to be had in great abundance, so that our largest structures in many cases can be constructed at a minimum of expense and with the best of materials.

A vast field awaits Wyoming along the line of bridge construction, as the time comes when her arteries of travel pierce the territory lying in the western part of the state, and their branches wind in and out and through the magnificent valleys and canyons of her great mountains. The pleasure of the tourist will be but just begun as he leaves the park and turns either to the south, the southeast, or the east, and continues his journey through Wyoming's great playground.

Missouri Cannot Use Motor Fees for Interest on Bonds

Automobile license fees can be used to pay off the principal of the proposed $60,000,000 Missouri road bonds, but cannot be used in payment of interest on the bonds, according to an opinion by Attorney General Barrett.

It is pointed out by the Attorney General that the amendment adopted last year authorizing the issuance of $60,000,000 of road bonds, specifically requires a direct tax upon property. He suggests two ways by which this direct tax may be avoided, either by amending the amendment or by appropriating from the state treasury sufficient funds to pay the interest on the bonds.

The wording of the amendment provides for the payment of the principal from motor fees, making no provision for the payment of interest from this source.

Pennsylvania Gets Lower Bids on Work

Bids received on 104 mi. of road recently by the Pennsylvania State Highway Department were from 15 to 20% lower than bids received for the same class of work last year, according to an announcement from the department.

Delaware River Bridge Will Cost $35,000,000

The proposed bridge over the Delaware River between Camden, N. J., and Philadelphia, Pa., is estimated to cost $35,000,000, according to the Joint Bridge Committee of the two states. Joseph K. Costello, Chief of the Bureau of Clalims in the office of the City Solicitor of Philadelphia, was appointed secretary of the committee, at a salary of $5,000 per year.

Highway Department Investigated

A certain county in northern New York had some special road work done. When the highway engineer presented his report of expenses to the county board considerable tumult was caused and a special committee was appointed to investigate the items listed under expenses. In due time it was found that the first item of $87 for stenographers was correct, but that in transcribing the second item of $56 for chemists, the stenographer made the serious error of putting an "e" instead of a "t" in the word "chemists."

Congress Fails to Appropriate More Federal Aid Funds

Although many members of Congress favored the appropriation of more federal aid funds, all efforts to enact such legislation at the recent session failed. The last attempt to put the good roads program through the Senate failed on Feb. 23, when Senator Harrison of Mississippi offered a bill appropriating $100,000,000 as an amendment to the annual agricultural appropriation bill. This rider was ruled out of order.

The House passed a bill appropriating $100,000,000 for federal aid, but this bill was buried in the Senate Committee on Roads, of which Senator Townsend is chairman.

It is rumored that there will be an investigation of the road situation before any additional funds are appropriated by Congress.

Road Work in Iowa

Iowa paved 46.58 mi. of the primary road system with hard surfacing in 1920 and graveled 102.82 mi. Drains on 221.3 mi. were also laid. At the end of the season 96 projects in 56 counties were in progress, the work carried over on these contracts including 112.9 mi. of graveling, 423.8 mi. of grading and drains on 229.5 mi. of road. This work is exclusive of county and township work.

Highway Funds of St. Louis County, Missouri

Failing to market $280,000 of road bonds at 95, the minimum allowed by law, the County Court of St. Louis County, Missouri, has ordered $100,000 to be taken from a sinking fund and transferred to the road fund. By this action $100,000 of the bonds are retired, for which the highest bid received was for 88.60. It is hoped to sell the remaining $180,000 of the bonds by private subscription to citizens of the county.

Immense Revenues from Automobile Sales Taxes

During the year ending July 30, 1920, the revenue from the automobile sales tax collected by the U. S. Internal Revenue Bureau totaled $144,494,448.79. This sum ranks third in size of revenues collected by the Government from all sources and shows the importance of the automobile industry as a source of income. The income tax yielded the largest income; taxes on tobacco were second in size, and the tax on automobiles sales came third.

Importance of Drainage in Road Construction

(Continued from page 146)

water from below by capillarity. He gives experimental data to show that after rainfalls the water in the soil rises to meet the percolating water. If this is true, then the value of the practice of partially saturating the subgrade before constructing the foundation may be questioned. It will be interesting to hear the experience of the Illinois Department regarding the results obtained.

Dense Non-Draining Soils

There is yet one further angle to drainage that needs discussion and investigation. A few of the clay soils tested in the laboratory at the Ohio State University are so fine grained and dense that water will pass through them only by capillarity. The attraction between the clay and the water appears to be so close that the water will not be transmitted to a more porous medium. A bowl, ½ in. thick, shaped out of these clays, will hold water for hours without showing additional moisture on its outer surface.

In one experiment, two 12-in. vitrified tiles were cemented together, making a 12-in. cylinder 4 ft. in length. This was roughened on its inner surface with neat cement mortar and filled with a given clay soil compacted as nearly as possible to the same degree as it originally was in the field. This cylinder full of soil, having a wire mesh across its lower end, was set vertically over a pan and water, 3 in. in depth, poured into the top bell of the pipe. The water gradually percolated away and more was added to maintain the 3-in. depth. After two or three days the water seemed to have ceased percolation and only evaporation seemed active. At the end of a week no water had dripped from its lower end. A ½-in. metal rod was then run down 2 ft. into the soil at six equi-distant points over its surface—the water all the while being maintained 3 in. deep upon the soil. At the end of the second week, no moisture being observable at the bottom end of the pipe, the rod was used again and six other ½-in. holes were sunk a full 2 ft. into the soil. The holes were enlarged by wabbling the rod around. These holes were spaced between those formerly sunk in the soil. For one week more water was maintained upon this soil and then it was allowed to evaporite off. About three months afterward the soil was dug out of the pipe and it was found that the water had never penetrated within a foot of the bottom of the pipe.

Based upon such evidence, the question immediately arises: Of what value is tile underdrainage laid in that kind of soil? Do not be deceived. Because this soil does not permit water to flow freely through it do not think that it remains stable and that it retains a high bearing power. One of the worst failures on a road in Vinton County, Ohio, occurred where this kind of clay outcropped in the subgrade. The problem of how to treat road foundations through this kind of clay has yet to be solved.

Porous Underdrainage Course

The writer has suggested for trial in Ohio that where dense clay soils are encountered at subgrade elevation, the roadbed trench be deepened from 4 to 6 in. and that depth of coarse, clean gravel or a uniform sized, clean, broken stone be spread beneath the regular foundation. This porous drainage course should be frequently connected with the side ditches or subdrains in order to free it from the collected water.

Summary

To summarize the paper:

1. Unprotected earth shoulders are easily rutted during spring thaws and wet seasons. These ruts provide easy access for water to reach the subgrade. Building water-proofed hard shoulders along a pavement serves a double purpose—it protects the subgrade from water and adds to the width of road. It may prove to be cheaper than rebuilt pavements.

(Concluded on page 154)

MEETINGS

Calendar of Coming Meetings

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 23-26—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

PERSONAL MENTION

N. K. Hay has resigned as city engineer of Sydney, N. S., Canada.

Ronald McKinnon has appointed city engineer of Sydney, N. S., Canada.

C. J. Rogers has been appointed county engineer of Jefferson County, Alabama.

D. K. Martin has been appointed a member of the Texas State Highway Commission.

J. R. Hunt has been appointed road engineer of Wyoming County, West Virginia.

W. W. McRoy has been appointed a member of the Texas State Highway Commission.

R. M. Hubbard has been reappointed chairman of the Texas State Highway Commission.

Hiram G. Hotchkiss has been appointed second deputy commissioner of highways of New York.

Percy W. Silverwood has been appointed secretary of the Wisconsin Highway Contractors' Association.

A. L. Hambrecht has been appointed division engineer by the Wisconsin State Highway Department.

C. F. Graesler has been appointed assistant engineer of the Minnesota State Highway Commission.

N. C. Hoyles has been appointed manager of the Cincinnati branch of the Pittsburgh Testing Laboratory.

E. S. Smith, formerly Director of Public Service, Youngstown, O., has been appointed chief engineer of the Ohio State Highway Commission.

O. A. Wakeman has resigned as secretary of the Wisconsin Highway Contractors' Association, to become secretary and treasurer of the Whitlow Construction Co., Charles City, Ia.

L. W. Wallace has been appointed secretary of the American Engineering Council. Mr. Wallace is president of the Society of Industrial Engineers and was formerly professor of railway and industrial management at Purdue University.

Importance of Drainage in Road Construction

(Concluded from page 153)

2. Dust-filled grass shoulders should be eliminated in order to prevent shoulder seepage into the subgrade.

3. Uncleaned ditches add largely to the expense of road maintenance, are unsightly, and in many cases are the direct causes of complete road destruction. The elimination of the ditch, so far as is possible, and the substitution of subdrainage, it is believed, will tend toward economy.

4. The practice of rolling clay subgrades should be carefully investigated to determine whether rolling increases capillarity and if so whether serious harm is done.

5. The whole question of capillary action of water in subgrade soils needs investigation to determine what treatment is necessary with different soils in order to best and most economically prepare the subgrade for the road.

6. The slaking and saturation actions of soils—in fact the whole range of soil and water reactions—should be investigated in order to formulate specifications which the engineers may use for any soil situation encountered in the subgrade.

7. Advantage should be taken of natural soil drainage by building the road on top of the original soil, as far as possible. Minimize the cuts. Multiply culverts. Conduct the water away from the road into natural channels as frequently as possible.

8. The question of how to prevent center longitudinal cracks in monolithic roads, and whether swelling soils have anything to do with these cracks, is propounded for investigation and observation. The presence of water in the soil is at the base of both of these actions.

9. The treatment of non-drainable soils to prevent them from being churned into plastic, unstable masses under the road, is a final problem suggested to the road engineer for solution. The porous drainage course beneath the foundation is offered as one solution.

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JAMESTOWN, N. Y., MARCH 16, 1921

Number 11

Highway Bridge Design*

By CHARLES A. MEAD†

It is the intention of this paper to dwell on some of the salient features in the design of bridges for New Jersey highways and the reasons for the construction adopted, in the hope that there may be produced structures of greater uniformity—adequate to meet all demands of traffic for years to come.

The state owns at present 704.2 mi. of highways on which exist 568 bridges of over 5 ft. span. They comprise timber, masonry and metal structures of various kinds, lacking in uniformity of specification and condition, but all of which are called upon to support the traffic which the development of the internal combustion engine has thrust upon them.

It is not the intention of this paper to criticise the design of a generation ago when a farm wagon or a load of hay was considered a heavy load. That bridges which were well designed for the loading of a by-gone day still give service shows in a measure what may be expected of those now building, for a well designed bridge will carry a large percentage of occasional overload without distress. Today, however, 80% of the existing bridges in this state are incapable of meeting the demands of modern traffic.

When the state assumed control of the highway system last year several very important bridges were on the verge of failure, two of the more recently constructed ones had actually collapsed and others needed immediate attention in various ways to keep them in service until major repairs or rebuilding could be reached. This repair work has proceeded along with the preparation of plans for the new structures designed for modern loading.

After a careful study of the various truck loadings actually in service and the tendencies of the times both from a military and commercial point of view, a loading was adopted, commonly referred to as a 20-ton truck, which would produce bridges adequate for the demands of modern traffic and provide

FAILURE OF A CONCRETE ARCH BRIDGE ON A NEW JERSEY HIGHWAY

FAILURE OF CENTRAL PIER OF A CONCRETE BRIDGE FROM SCOUR for such increases as are sure to come. The loading, therefore, is not so much a typical truck as a live loading which will produce serviceable bridges.

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*Paper presented at the annual meeting of the New Jersey State Association of County Engineers, Trenton, N. J., Jan. 25, 1921.

†Bridge Engineer of New Jersey.

The geographical location of New Jersey between the two great commonwealths of New York and Pennsylvania makes it imperative that her structures should be of the best.

Restrictive legislation to be permanent must be in accord with the demands of commerce. Growth far beyond the vision of traffic experts in every other mode of transportation has been experienced, and highways will prove no exception to the rule.

The number of miles of road per bridge varies considerably—from 0.5 on Route 16 to 8.1 on Route 14. By far the greater number are located in the north. Roughly, 60% lie in the northern part, 29% in the central part and but 11% in the southern part of the state.

AN ABUTMENT FAILURE DUE TO IMPROPER FOUNDATION CONDITIONS

In the northern part of the state the deeper cut streams which have found their ultimate beds have more definitely fixed profiles which give less latitude for span length and skew than in the southern part where these conditions are reversed. Destructive floods are consequently more frequent in the northern parts.

It is to be regretted that no adequate financial provision has been made in New Jersey for a comprehensive system of stream gaging, the data obtained from which, through a period of years, would be increasingly valuable and useful in many ways for the economic development of the state.

Each bridge site receives study to determine the proper area of waterway. Existing openings are noted, shape and size of drainage areas determined and estimates are made of rainfall and run-off. These data are checked by the Talbot formula and the desired area of waterway determined. This procedure is facilitated by the existence of a complete and accurate topographic map of the state which eliminates much survey work and greatly reduces the cost of preliminary investigation. Subsoil conditions are studied at pier and abutment locations and foundations designed in accordance with the findings.

Deck bridges, being the most economical in first cost and maintenance, are to be preferred wherever the conditions are favorable. Long spans and low head room often compel the use of through or half through bridges. Of these the most economical is the plate girder. Beyond the limits for plate girders the more elaborate lattice girders must be used, giving preference in all cases to riveted over pin connections because of the greater rigidity possible. For spans up to 20 ft. reinforced concrete slabs are to be preferred. Encased I-beams may be used up to 30 ft. Beyond that, built-up sections must be resorted to. Transportation limitations must be considered as a material factor in design.

Concrete, being a durable structural material of low cost and diversified application, finds almost universal use in the modern bridge. Used in mass work for substructure and in combination with reinforcing steel for superstructure parts subject to transverse bending, it forms an ideal material for permanent structures. Even though its properties are so universally known and appreciated, it requires careful and honest workmanship and good design to produce enduring results. Walls may be either gravity, monolithic or reinforced slab types. The resultant line of pressure should be carefully determined so that toe pressures will not exceed the maximum allowable, or movement perhaps fatal to the structure will result. They should be self sustaining under all conditions of loading and have adequate provision for expansion. Their footings should be set at a depth which will insure them against damage from frost or scour. In streams which have found their ultimate beds, from 4 to 6 ft. below the stream bottom will be sufficient. In material incapable of supporting the required loads without unduly spreading the footings, some other means must be used to carry the loads to a substratum which will provide adequate supporting power. For moderate depths with fairly compact intermediate strata, so confined as to remain undisturbed, piles of wood or other material will be found most suitable. Wooden piles will usually be found most economical, provided they can be cut off below low water line. For deeper foundations of major importance it will be necessary to use the more expensive but reliable open cofferdam or pneumatic caisson types. Happily the necessity for these more expensive substructures exists at few locations.

(Continued on page 160)

Types of Pavements*

By JAMES H. MACDONALD†

At the very outset I wish to disclalim any intention of exploiting my knowledge or appearing in any way in the role of an instructor. I purpose simply to relate what has taken place under my observation and experience. I am also mindful of the fact that I am on dangerous ground with corporations and contractors who have goods to sell. Although occupying, for the time being, "Coward's Castle," I shall not abuse my privilege, but shall treat fairly the question of the different kinds of pavement of which I may speak.

The city street and the country road are united by ties that bind, and we cannot, if we would, destroy the union. All of the city and country interests are so much a part of each other that it would be a very difficult matter to separate them. The country road is a continuation of the city street; and, as they radiate from the city lines, the circle widens, and the system takes on new features. As the circle widens and continues, new highways are met and taken up, and thus a continued chain of highways is formed, from city to city and to the border line of the state. And the same process is continued beyond that line and an endless chain of highways is thus established.

It is not only in this respect that the city street and the country road are married, but also in a nearer and closer sense, for the interests of the people who reside in the city are so nearly related to the interests of those who live in the country that it would not be possible for the dweller in the city to be wholly independent of the husbandman, nor for the farmer to get on without his brother in the city.

Upon any business day in the year, if we stand in the center of any of our large cities in the early morning when the great arteries of trade begin to pulsate, we hear first the distant tap-tap of the horses' hoofs and the rumble of the wagons starting out upon the day's business, coming nearer and nearer until finally from every corner appear horses and wagons. What was at first only a sound has become a reality of living and moving things, in which can be seen trolley cars, light carriages and wagons, drays, carts, and every kind of freight carrying vehicle. Every moment of the entire day the pavements are put to the limit of endurance. Should you count the horses and wagons and the amount of freight for which the city has to find transportation you would be appalled at the results. All day, hammer and pound, rattle and jar, on our city streets, and this is continued year after year and pavements have to be worn out. Flesh and blood cannot stand the strain, horses and wagons have to give up and others take their places, and the strain is continued. But this is not all. Underneath the pavements is a perfect labyrinth of pipes and wires, in obedience to the demands of modern times; and it has come to pass that our streets underneath the traveled path are as important as the surface. Sewer, gas, water and steam pipes are everywhere. Telephone, telegraph and electric wire conduits are being put down. The cable and trolley cars all combine to do their deadly work to the pavements. Holes are dug here and holes are dug there, and very often the filling is improperly put back into the trenches, and the pavement very carelessly replaced. Even if the greatest care were to be taken in putting the material back into the trenches, and if the relaying of the pavement were done as well as possible, it would be an impossibility ever to have that pavement in its original condition so as to be part of, and in conformity with, the grade first established. All of the forces working on the surface and underneath seem to be in conspiracy against, or at war with our pavements. This state of affairs is in evidence every day, and it is nothing short of a miracle that our streets are in as good condition as they are. These facts certainly furnish food for reflection and call loudly for the best efforts of the engineer to successfully combat these influences that are at work upon our system of city pavements.

To overcome these influences and to preserve and protect our city streets today, require a heart to conceive, a head to plan, an eye to see, a hand to execute, and the courage of his convictions on the part of every engineer who has charge of the improvement or the care of our city streets.

It will be conceded that in no department of public works has more money been spent, and practically wasted, than in our search for a permanent pavement for our cities. I firmly believe that a permanent pavement for our cities will be found that will nearly, if not quite, answer the demands upon it. I do not think, however, that we have that pavement today. Every pavement in use in our cities falls short of the requirements in many essentials. We have begun to see what we need; and all the mistakes we have made in our seeking for light in the past will be our best assistants to accomplish the desired result. Engineers cannot do it all, unless they receive the assistance and cooperation of their city administration. They must have, as an assistant, every corporation and every artisan seeking to occupy our streets. And this is not all; the citizens must give their individual assistance in a ready acquiescence to the demands of the trade. How many times have we seen a pavement suitable only for a residential street laid upon a business street, and an expensive pavement laid upon a residential street where one of less cost would have answered every requirement. In these last named instances, have enginers fully realized that:

---

*Paper presented at the 18th annual convention of the American Road Builders' Association, Chicago, Ill., Feb. 9-12, 1921.

†Former State Highway Commissioner of Connecticut.

> "Each man, a world to other worlds half known,
> Turns on a tiny axis of his own;
> His full life orbit is a pathway dim
> To brother planets that revolve with him."

In the building of any pavement, the two essentials are the surface and the foundation. Every well or properly constructed pavement should be laid upon a proper foundation. In the past, insufficient attention has been paid to the building of proper foundations upon which to lay our pavements. I am not prepared to place the fault at all times upon engineers, for many times the actions of the engineer are controlled entirely by others in charge of the work. It has been too often the case in the past that a question of expediency or expense has been at fault, rather than obedience to established rules for the proper laying of the pavement. Anyone who has watched the growth of the hamlet into a large and populous city must have noted the transitions through which this growth has taken place. First a few houses are built near the center, after which the meeting-house is erected, the school-house and the store; then the introduction of manufactories, which called for better and more rapid transportation than the road afforded in the bringing of the raw material and in sending out the finished product, namely, railroads. As the little village grew rapidly into a city, the farms which had clustered all around the little settlement were taken up and the undulated surface was brought to the level required for sidewalks, drainage and the pavements. In this leveling is used an indiscriminate mass of earth, clay, loam, sand, gravel, ashes, and everything that can be found at a reasonable cost to accomplish the purpose. In excavating in all of our large cities we find such material, which furnishes a very uncertain footing for any pavement that it is desired to place upon our streets. A single glance at the material excavated from any of the trenches in the streets of our large cities will prove the truth of this statement. With this condition of affairs to be met, the greatest care must be taken in the building of foundations upon which to lay our pavements.

During the past five years more attention has been paid to foundations, and we have now in very general use the concrete base. But the trouble with our concrete base is standard depth, which is rarely, if ever, increased, no matter upon what material it may rest. Commissioners who have to deal with the question of state roads change the character of the foundation with each condition they meet in their work. I wish the same might be said of every engineer who has to do with city work. In the opening up of any permanently laid pavement, and in the cutting down through the foundation to make excavation for connections, there are not enough safeguards or prohibitive measures in the ordinances or in the issuing of permits to men who enter upon any of our city streets to make connections. It is an expensive matter to allow contractors to dig up our city streets and roughly or carelessly throw back the material excavated and improperly relay the pavement. A system of perfect inspection by competent men should be had in every one of our large cities over all work of this kind. The pavement should not be put back immediately.

The greatest care should be taken in providing suitable foundations for the building of all of our permanent pavements. Any pavement, whether gravel, macadam, granite block, brick, rock or sheet asphalt, should have a foundation built sufficiently deep on every subgrade where it is uncertain whether the existing substratum can properly hold up the pavement.

It would be difficult to outline any method of highway improvement to be rigidly followed by every town, every county and every state in the Union. No standard work in print today will equip the engineer with that degree of information necessary to treat every condition of road construction by which he may be confronted. Conditions change, in climate, in the materials to be used, in accessibility to railroad facilities, and in a thousand and one things which do not always appear to the man who writes the text-book. Text-books are necessarily written from the point of view of the experience and the conditions surrounding the author. While he may adapt himself to these conditions, every engineer, in taking up this great question, will find every day is development, every day is going to school. New features are continually requiring his most careful thought and consideration. What he might outline as the proper thing to be done in one place, would not be right treatment in another. In some of our states the low lying plain predominates; in others there is a preponderance of stone. The coast line suggests one character of road, the valleys another, and the mountainous parts of the state another. In one is found plenty of stone, remote from railroads and from a crushing plant, while in another state no stone is to be found, but plenty of gravel is to be had on every side. In still another state we find the sand plain, with neither stone nor gravel. In some places a heavy depth of clay is found everywhere. In Kansas we have 7 ft. of solid black loam, with no stone. In California many parts of the state are all sand.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

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TAXING GASOLINE TO PAY FOR ROADS

A tax on gasoline, the proceeds of which would be used to retire a state road bond issue, is under consideration in the Oregon Legislature and the newly enacted highway law of North Carolina contains a provision for levying a like tax for a similar purpose, according to recent news reports. Some weeks ago, as was noted in this column in the issue of Feb. 9, one of the officials of the California State Highway Department proposed the levying of a gasoline tax, suggesting that it would be well for the states to take such action in view of the fact that Secretary Houston had recommended the imposition of a federal gasoline tax.

The inherent fairness of a gasoline tax has been pointed out several times in these columns. It would impose a more nearly equitable burden upon motor vehicle users than any existing system of taxation, because it would take into account not only the weight, value and power of the vehicle, but also the amount of the vehicle's use. It should be obvious that any plan of taxation that does not take this last named factor into account cannot be fair, for it is self-evident that a comparatively light car driven several thousands of miles in a season will inflict more damage upon the roads than will a much heavier vehicle that is used very little. Most present and proposed laws do not take into account the amount of use. The man who drives a certain kind of car ten thousand miles in a season pays exactly the same amount as another man who drives the same kind of car only a few hundred miles.

It is to be expected that proposals to levy a gasoline tax will encounter determined opposition. It is probable that automotive interests and car users will present an almost united front against them. On the other hand, it seems highly probable that such proposals will be made with increasing frequency. The experience of the states that are pioneers in the movement can be observed with interest and profit.

A ROAD CONVENTION IN CHINA

A road convention is to be held in China in the spring, according to a recent report, note of which is made on another page of this issue.

While details of the plans are not known, the mere fact that such a meeting is contemplated would seem to indicate an awakening in that country to the importance of roads—something that if true will mean more for the commercial prosperity, educational advance and the general progress of the country than almost any other one factor.

China is a nation of vast area and little realized possibilities. Its population is something like 400,000,000, or not far from a quarter of the total number of people in the world. Its area is approximately 7½% of the entire land surface of the earth. This means an average density of population very nearly equal to that of the State of Illinois.

Taking into account these figures, the fact that the country is practically without roads and the tremendous value of the country's natural resources, it is possible to get some idea of what good roads might do for the Chinese.

There is another side to the matter. While China has the labor for carrying on an unlimited road building program, she has little else. The work would have to be directed by foreign engineers and such machinery as was used would have to be imported from other countries. The matter is one that should attract the attention of American engineers and American manufacturers.

Road building in China, however, will be a difficult task and one with its own peculiar problems. Over large areas there is an utter lack of stone. This will mean the importation of stone, probably impossible in much of the territory, or the devising of means for utilizing the soil of the vast alluvial plains. There are also the superstitions and customs of the inhabitants to overcome and these are bound to form no mean obstacle.

Highway Bridge Design

(Continued from page 156)

Proper attention should always be given to drainage. With weep holes provided in walls and the entrances to these holes properly guarded by rip-rap or French drains the back pressure from hydraulic heads will be reduced so that the theory of earth pressure will be realized.

Cast iron or reinforced concrete pipe of proper design and having proper headwalls will usually be found economical for openings of less than 40 sq. ft. For larger areas culverts should be used. They may be single or multiple monolithic arches or reinforced concrete slabs. If boxes of reinforced concrete are used the bottom slab should have the same care in the arrangement of reinforcing material as any other part of the structure, for the load carried is equal to that on the top slab.

Owing to the difficulty of making concrete entirely water-tight, and as water is almost a universal solvent, it is of the utmost importance that the entrance of water to any part of the structure be prevented. This is especially true of parts not accessible for inspection. Paint on metal work is effective on parts exposed to air which aids in the rapid removal of moisture. Structures should be so designed that all possible parts can be inspected. In the case of inacessible parts, such as imbedded steel, if reached by moisture, changes will occur and may progress with surprising rapidity, especially if electrolytic action is present. Where there is no actual leaking, the presence of water will be indicated by surface staining, indication of leaching and spalling most strongly marked at joints or pour lines. The formation of rust scale on embedded steel sets up great pressures, recorded as high as 4,700 lb. per square inch, which will destroy the bond and eventually menace the safety of the structure. Water should, therefore, be conducted away from the bridge as rapidly as possible by providing drainage grades in every part. Inaccessible parts should be protected by waterproofing, which is cheap insurance. With waterproofing cost at 2% of the cost of the structure and money at 4% it is evident that if waterproofing prolongs the life of the bridge six months it pays to do it.

In regard to the construction of floors: Because of under-clearances and the reduction of dead load, it is generally desirable to produce the thinnest floor consistent with good design. This can be accomplished by carrying the live load directly on the floor slab after providing a small extra thickness of concrete cast integrally with the slab for wearing surface. Otherwise, to protect the slab from wear, the entire surface may be covered with some bituminous compound applied in a plastic condition or with paving blocks of wood or other material. The latter makes a slightly thicker floor than the former.

The width adopted is 30 ft. between curbs for all new bridges; and sidewalks are to be provided where required.

The distribution of load concentrations on slabs is a subject which is being intensively studied from the meager data resulting from destructive tests. The tendency is to slightly reduce the slab thickness from the old assumptions of distribution wherein the load was distributed at 45 deg. in each direction to the plane of reinforcement, resulting in a somewhat lighter and cheaper bridge. Further tests are needed, however, in order to fully cover this subject.

Where floor thickness is not a material factor, conditions more nearly approaching ideal may be realized in small spans by locating the slab low enough to permit the road construction to be carried continuously over the bridge. In any case, the road paving on the bridge should extend continuouslly from curb to curb.

Slab floor bridges of short spans on solid supports will usually be found stiff enough to provide for lateral, longitudinal and centrifugal forces. The necessity for adequate bracing in all directions should never be lost sight of, to the end that the resulting structure be rigid under all conditions. Unless a bridge can be used as unrestrictedly as the highway it connects, it is not an adequate bridge.

Bridge railings, to afford necessary protection, should be designed to be capable of withstanding the impact from unmanageable vehicles of the weights specified. A monolithic concrete railing well reinforced will be found adequate. Such a railing is not an extravagance, as it can be produced at a cost about equal to a heavy galvanized pipe railing and is vastly superior to it in strength, endurance and appearance. It is the practice to mold the state's name, route number, and year of erection in these railings.

The only impression gained of a bridge by the traveling public is that attained by the appearance of the railings. These should leave in the mind the pleasant sensations of safety and harmony.

There seems to be a widespread notion that arches are beautiful. Some are. Being predicated on immovable abutments they should never be used in flat marshy country where there is the slightest question of security concerning the foundation material. Simple spans giving vertical reactions can be made attractive in appearance and when they are in harmony with their surroundings and express a structural necessity they are pleasing.

Good design requires an arrangement or grouping of parts so that the eye is led to consider the structure as a whole rather than an accumulation of unrelated pieces which lack interest because of their incongruity. It need not cost any more to produce structures which are pleasing to the eye than those which are displeasing. The matter of aesthetics is, therefore, of great importance.

Viaducts, being simply a succession of connected simple structures, are subject to the same laws as simple spans. Especial care should be taken that their supports provide the rigid bracing and anchorage required.

Movable spans are often required over navigable streams. Their design should follow the principles herein outlined, the particular type being selected for its fitness to the location.

Questions are often asked concerning bridge standards and requests are frequently made for them. This work can easily be over-systematized. It is possible to standardize certain structural parts of bridge such as decks, abutments, walls, floors and railings; and this has been done. It is not practical to standardize the assembly of those parts, because it is very rare to find two physiographic locations where exactly the same structure will fit—hence the term "standard" as applied to complete bridges is a misnomer.

Wooden bridges or trestles may be proper in some locations notwithstanding their inflammability. With timber properly treated to resist decay and the destructive attacks of the various marine borers, a properly designed structure with good maintenance will give upwards of 15 years' service. These must in any event be regarded as structures of expediency, having a temporary nature, to be replaced by more permanent ones as occasion demands. Timber structures, with their necessarily weak joints, must have especial attention given to bracing.

Questions of economics and expediency so largely enter into this subject that only the most general principles can be stated. All things considered, that bridge which is best for a given location is the one which will provide safe and adequate service at the lowest cost and be in harmony with its surroundings. Such bridges we are endeavoring to construct.

Cleveland Rejects $500,000 Paving Bids

Paving bids aggregating over $500,000 were recently rejected by the Service Director of Cleveland, Ohio, it being held that in every case the price was too high. The bids were for work on 13 streets. The projects will be readvertised.

New Jersey Bridge Commission Members Do Not Want Compensation

Members of the New Jersey Bridge and Tunnel Commission are a unit in opposing the passage of a bill before the Legislature providing salaries of $3,000 a year. In discussing the matter, Samuel M Shay of the commission, stated that he would refuse to serve on a paid commission.

"Each commissioner," he continued, "is proud to be identified with two of the greatest projects ever started in New Jersey. To place us on a salary would detract from that honor. I do not believe that any commissioner knew of this measure before it was introduced in the Legislature."

Illinois Road Bids Lower

Bids for 125 mi. of highway recently opened by the Illinois State Highway Department show considerable decrease as compared with 1920 bids. The average cost in 1920 was $44,000 per mile. This year's bids show an average of $37,850 per mile for northern and central Illinois, and $44,250 for southern Illinois.

Contractors state that bids would have been much lower but for the increased freight rates, which are 40% higher than last year. Specifications this year call for an 18-ft. road, while the specifications last year called for a 16-ft. road.

Bituminous Concrete Foundations

A Summary of Their Advantages from a Paper Before the Illinois Society of Engineers

Bituminous concrete foundations under pavements of various types have proved so successful that they have been discussed at considerable length in various meetings of road builders. In view of this, the subjoined summary of their advantages will be of interest. The summary is taken from a paper read before the Illinois Society of Engineers, by Hugh W. Skidmore, of the Chicago Paving Laboratory, and is as follows:

"(1) Provides homogeneity of mass and positive bond between foundation and wearing surface when bituminous top courses are employed.

"(2) Provides uniform contact with the subgrade, thus insuring the benefit structurally of all of the beam strength possessed by the foundation slab and, by the same token, makes certain uniform distribution of load to the subgrade.

"(3) Because of the inherent flexibility of the material, the foundation slab will at no time be called upon to act as an arch over weak subgrade areas; therefore, the possibility of the foundation rupturing, as is frequently the case with Portland cement concrete, will be reduced to a minimum.

"(4) Provides freedom from cracks and upheavals.

"(5) Insures against the presence of moisture in the foundation structure, thus prolonging the life of the pavement.

"(6) May be easily repaired at minimum cost, the surface patch method being applicable except in the case of very serious defects.

"(7) Provides decided economies in construction, as it disposes of the equipment and organization necessary to lay cement concrete, thus affording the contractor the advantage of exclusive use of that portion of his ordinary equipment and labor organization which in actual operation has heretofore proven to be the most economical, and thereby profitable.

"(8) Does away with the long period of time required for curing of the foundation, thus permitting the opening of completed work to traffic immediately and providing a rapidity of turnover to the contractor not possible in the case of rigid foundations.

"(9) Permits the use of the same materials, except cement, as are employed in cement concrete work.

"(10) Under similar conditions, using the same aggregate materials, bituminous concrete of equal thickness will be found to be cheaper than cement concrete at present prices."

Governor Davis of Washington Outlines Highway Program

In view of the fact that the Washington Legislature has repealed the 2-mill state highway levy law, Governor Davis recently in a special message to the Legislature outlined a highway program to be followed during the next two years. He asks that legislation be passed enabling the sale of $2,000,000 road bonds voted the last election, and the proceeds be distributed by alloting 60% to the various counties proportionate to the amounts contributed by the counties in 1920. The remaining 40% is to be used in neutral zones. Compulsory cooperation in the construction of state highways should not be required. Counties should be allowed to build state highways on their own initiative and should be allowed to bid on road contracts.

Pennsylvania Rejects Many High Bids

Commissioner Sadler Says Bids Did Not Reflect Lower Labor and Material Costs

Out of 26 bids opened by the Pennsylvania State Highway Department on Feb. 18 for 1 bridge and 26 road projects, 19 bids were rejected as being too high. The official statement of State Highway Commissioner Sadler explaining this action follows:

"I feel that the prices submitted on a great majority of the projects for which bids were opened Feb. 18 are not representative of the downward trend of prices for labor and materials.

"While it is urgent that the Pennsylvania State Highway Department make every effort to complete the projects which will give Pennsylvania a continuous system of durable highways, it is important that the resources of the state be conserved. There is no reason why this state should pay any more for its work than private individuals or corporations. For the last three or four months labor costs and material prices have been decreasing, but these decreases have not been adequately reflected in the bids submitted to this department Feb. 18. For that reason the rejections are made.

"The projects will be readvertised within a short time with a view of obtaining reasonable proposals."

Chinese Plan Good Roads Convention

Plans are being made for the holding of a good roads convention in Shanghai, China, in the spring, according to C. T. Wang, Chairman of the Good Roads Committee of the recently organized Pan Pacific Union. Mr. Wang, who was one of China's delegates at the peace conference at Paris, is enlisting the aid of civic and commercial bodies to support the plan.

Granite Headers in Chicago Asphalt Macadam Pavements

Correction of an Erroneous Statement in a Previous Issue Regarding Dimensions

Our attention has been called to a typographical error in the article "Paving on Chicago Streets," by H. J. Fixmer, Division Engineer of the Board of Local Improvements, printed in GOOD ROADS for Feb. 2.

On page 62 of that issue, in the paragraph describing asphaltic macadam construction, the following sentence appears:

"In addition, a 40x10-in. granite header is being tried adjoining the four rows of granite block." The dimensions of the header are, of course, 4x10 in. and not 40x10 in.

North Carolina Passes Highway Act

Measure Provides for a 5,500-Mile State Highway System, a Commission of Ten to Administer Law, a $50,000,000 Bond Issue, a Gasoline Tax and the Use of Convicts

A bill providing for the construction and maintenance of a state highway system was recently passed by the North Carolina Legislature. A bond issue of $50,000,000 is authorized to carry out this work, together with motor vehicles fees and a tax of 1 ct. per gallon on gasoline sold in the state. It is expected that $10,000,000 of bonds will be sold this year.

The state will be divided into nine districts and the funds allotted to these districts on the basis of area, population and mileage of state highways. The law provides for the appointment of a commission of ten members, one from each district and one at large. The employment of convicts on the roads is also contained in the provisions of the law. About 5,500 mi. are embraced in the proposed system.

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The Lower House of the North Carolina Legislature on Feb. 17 passed a measure authorizing the expenditure of $50,000,000 on state roads.

HIGHWAY TRANSPORTATION

AGA Highway Lighthouses

Flashing Beacons of Three Colors Show the Kind and Degree of Danger at Curves, Grades, Highway Intersections, Railroad Grade Crossings and Points of Congestion

Installation of the highway lighthouse on many important highways in different parts of the country for the control of motor traffic, is announced by the A. G. A. Company, of Elizabeth, N. J., marine lighthouse engineers and builders, whose marine lights are in use at sea by the leading nations of the world.

One of the important installations just announced is that on the famous old highway between Washington, D. C., and Mount Vernon, where over 12 highway lighthouses are used to mark dangerous curves and grade crossings. The lighthouses are miniatures of the beacons used by the company for traffic control on the Panama Canal and show flashing lights day and night.

The color standard of the company on all highway signals is that adopted by the Committee on Standards of the American Association of State Highway Officials, as follows:

Red, indicating first degree danger, to be used only at railroad crossings, dead end of road, or lift bridges;

Yellow, indicating second degree danger, at curves and grades, where driver must slow down and proceed with caution;

Green, indicating moving or traffic danger only, and to be used at road intersections.

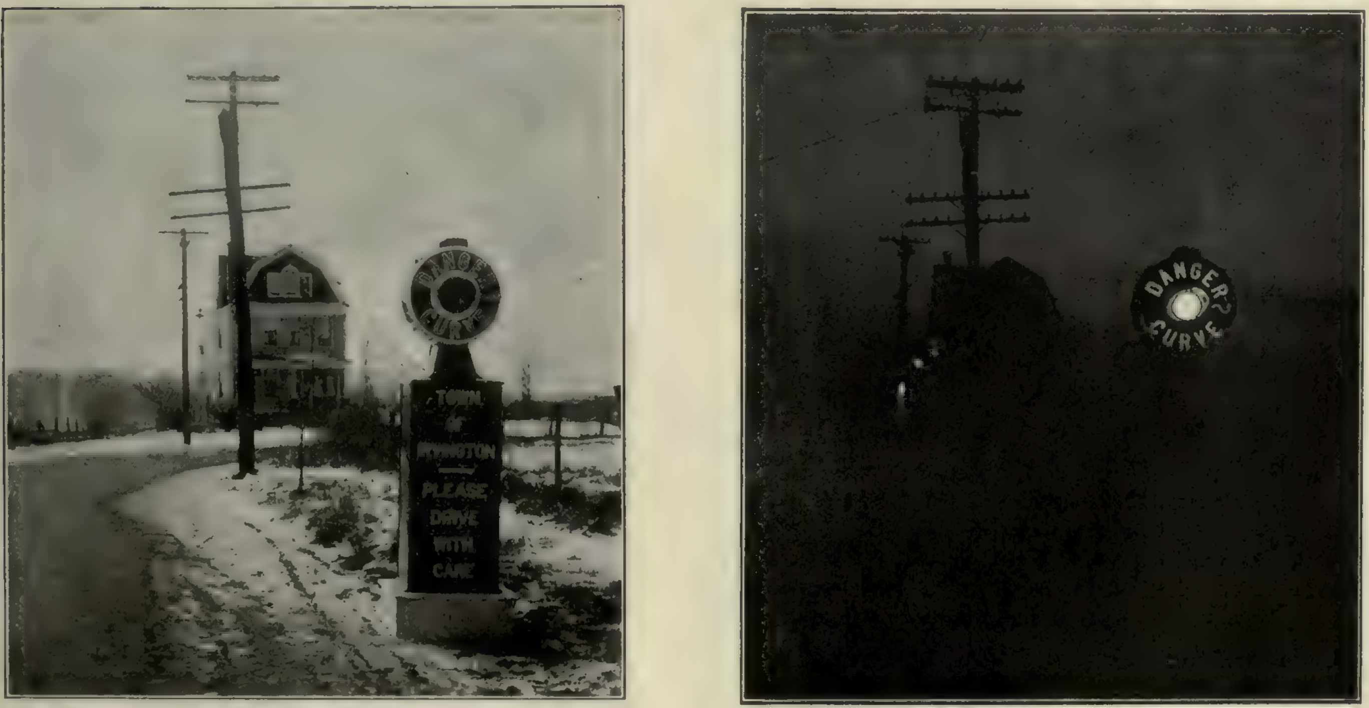
The accompanying day-and-night photographs of the lighthouse show an installation at a dangerous curve on the county highway to the south of Irvington, N. J., where Commissioner of Public Safety Leonard Setaro has already installed many traffic beacons for the control of traffic in the center of the town.

The flashing light at the curve is expected to seafeguard traffic at a point long considered very dangerous.

In addition to the installation of the highway lighthouses, the engineers of the company report that fully 200 cities and towns throughout the country are now standardizing on the color system recommended by the American Association of State Highway Officials.

The flashing lights used in both the city and town traffic beacons, and the highway lighthouses, are automatic in operation. Fuel is supplied by an acetylene gas accumulator in the base.

The flashing light is recommended as an effective signal for those who are color blind, and as a warning easily distinguished from ordinary plain or colored lights.



Appearance by Day

View at Night

AN "AGA HIGHWAY LIGHTHOUSE" INSTALLATION AT A CURVE NEAR IRVINGTON, N. J.

Gasoline Tax Proposed in Oregon

A bill before the Oregon Legislature proposes to place a tax of 1 ct. per gallon on gasoline, the revenue to be applied to the retirement of state hghway bonds. It is estimated that the tax would yield $375,000 annually.

Michigan May Tax Drive-aways

A bill proposing to place a tax of $3 on each car driven away from a factory over the roads of Michigan has been introduced in the Michigan Legislature. The measure, it s stated, finds its principal support in the country districts, but is very much opposed by automotive interests.

Ohio Court Upholds Right of County To Limit Bridge Loading

The right of the county commissioners of Mahoning County, Ohio, to place a limit on loads on county bridges lower than the 12-ton limit of the state law, was upheld recently by the Youngstown Court of Common Pleas. Trucking interests attempted to restrain the county from arresting drivers attempting to cross bridges with loads in excess of the county limit. The court held that there was no conflict between the state and county laws and that the county was empowered to protect public property at all times.

EQUIPMENT—TRADE—MATERIALS

Contractor's Plant on a Concrete Road Job

Industrial Railroad and Central Loading Station Used by Blaisdell Construction and Engineering Corporation on a Cement Concrete Paving Job Near Allentown, Pa.

In 1919 the Blaisdell Construction and Engineering Corporation started work on Project No. R-157 in Lehigh County, Pennsylvania, extending from the Allentown line to the Berks County line, a distance of 35,000 ft. The specifications called for an 8-in. reinforced concrete pavement, 18 ft. wide. Trucks were used in transporting materials over the subgrade, but because this method of transporting aggregate carried with it numerous disadvantages, such as cutting up the subgrade, loss of material and contamination of mix, it was decided to install an industrial railway to complete the remaining half of the job in 1920.

VIEW OF CENTRAL LOADING PLANT

At the middle point of the job a branch line of the P. & R. R. R. intersects the road, and it was at this place the central loading plant was located. Sand was brought in on standard gage cars and transferred by a stiff leg derrick to loading bin or stock pile. Crushed rock was obtained from a crusher installed by the contractor at a quarry nearby and transported by motor trucks to the job, where the trucks ran up a wooden incline onto a platform, dumping the rock on the stock pile. From the stock pile the rock was transferred to the loading bin by the derrick.

TRAIN AT MIXER—DUMPING BATCH BOX

Cement was received from a cement plant about 10 mi. away by motor trucks and stored in a shed adjacent to the loading bin. Because the sand supply was not distant, the contractor was enabled to retain the same cars, thereby being assured of a constant supply of sand. And because this contractor obtained his cement and rock from a convenient source of supply, lack of materials was not one of his problems, as it was with most other contractors.

The loading bin straddled the industrial railway track and was divided into two compartments for sand and rock, having a total capacity of about 75 cu. yd. The chutes of the bin were of the Easton radial gate type.

In the construction of this road, which is undulating with grades up to 6½%, a 1-yd. Foote mixer and Easton industrial railway equipment were used outside the grade. The mixer started at the loading plant at the center of the job. Turnouts were provided at the loading plant, the mixer and half-way. Easton cars equipped with standard 5-bag batch steel tip-over batch boxes with compartments to separate the aggregates were used, the batch boxes being provided with cement compartment covers to keep the cement dry and to prevent loss of material. Two 6-ton locomotives were used with 3 trains of 4 or 5 cars, one train being at the mixer, one at the loading plant and one en route, each train carrying 12 to 15 batches. The service was so well timed that the mixer was always busy. In spite of a late start and hold-ups because of rain, the progress of construction was very good.

Perhaps the most interesting feature of this job was the use of the new Easton 3-box car unit, which has recently been placed upon the market. These units carry three batch boxes which hold up to 35 cu. ft. each, or two of the large 54 cu. ft. batch boxes. By the use of three batch boxes on a car, a greater amount of material can be carried and the handling is rendered easier. Since two 3-box cars do the work of three 2-box cars, the first cost of car equipment is less and the maintenance costs are also reduced. The train is shorter, the dead weight of the cars less, and fewer cars have to be coupled and uncoupled. Shorter loading bins are also made possible.

Lakewood Engineering Company Appoints Canadian Representative

The Lakewood Engineering Company, Cleveland, O., has announced the appointment of Kelly Powell, Ltd., Winnipeg, Canada, as agents for the Provinces of Manitoba, Saskatchewan, Alberta, and western Ontario.

Three New Tarvia Booklets

Three new booklets on Tarvia have recently been issued by The Barrett Co., 17 Battery Place, New York, N. Y. They are of uniform size, 9x6 in., and are all profusely illustrated by half-tone reproductions of photographs of completed Tarvia pavements and Tarvia treated roads and of Tarvia construction, maintenance and reconstruction in progress.

One of the booklets is devoted to the construction of Tarvia pavements by the penetration method, with passing reference to the use of Tarvia in the mixing method, in maintenance, in repair and in dust prevention. This booklet consists of 36 pages and covers and is illustrated largely by full-page cuts.

The second booklet describes the construction of Tarvia macadam roads, according to the "Tarvia filled macadam specification." Like the other booklet, it is very profusely illustrated and contains a detailed description of construction methods.

The third booklet is devoted particularly to surface treatments, but contains brief descriptions of the various grades of Tarvia and their uses in road work. The majority of the illustrations in this booklet show completed Tarvia pavements and Tarvia treated roads in this and other countries. The booklet is printed in two colors and contains a number of striking full-page illustrations.

Buffalo-Springfield Roller Company Opens Chicago Offices

The Buffalo-Springfield Roller Co., of Springfield, Ohio, manufacturer of the Buffalo Pitts and Kelly-Springfield road rollers, has announced the opening of offices in Chicago, Ill.

The offices are at 975 Old Colony Building at Van Buren and Dearborn Sts. They will facilitate the company's service to customers in Chicago and its vicinity.

E. H. Edwards, who has been in the machinery business for many years, will have charge of the new offices.

New Booklet on Texaco Asphalt Macadam

A new booklet entitled "Texaco Asphalt Macadam," has recently been prepared for free distribution by the Asphalt Sales Department of the Texas Co., 17 Battery Place, New York, N. Y.

The booklet describes the construction of Texaco asphalt macadam roads, starting with the foundation and thoroughly covering the various processes necessary to complete the paving. The text is illustrated by a number of cross-sections and by reproductions of photographs showing various steps in the construction and maintenance, and completed roads.

The booklet is 6x9 in. in size and consists of 12 pages, including covers.

Patented Pavements May be Used in Illinois Cities

Recent Decision by Supreme Court Holds Law Permitting Their Use to be Constitutional

Patented pavements may be used in Illinois cities, according to a decision recently handed down by the Supreme Court of that state.

Previous to 1919, the use of patented pavements by the cities of the state was prohibited under the Supreme Court's interpretation of the existing law. The Legislature then passed an act permitting municipalities to contract for the construction of patented pavements provided that these pavements were placed in competition with types not patented. Acting under this statute, the City of Rockford received proposals for several types of pavements, including Warrenite-Bitulithic, the patents on which are held by the Warren Bros. Co., of Boston. A taxpayer's suit was instituted to prevent the work, on the grounds that the 1919 law was unconstitutional and that the proceedings had not fully complied with the act.

The decision recently handed down holds that the act is constitutional, thus sustaining a decision by the county court over a year ago. The case has been in the courts for nearly two years and the final decision is of interest not only in Illinois, but in other states.

MEETINGS

Calendar of Coming Meetings

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12.—Canadian Good Roads Association.—Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 23-26—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

Iowa Road Officials' Conference

The eighth annual Iowa Road Officials' Conference will be held on March 23, 24 and 25 at Ames. County and town officials will discuss the various problems encountered in their work and a number of prominent highway engineers will make addresses. On the evening of March 24 the annual banquet and smoker will be held, at which Governor Kendall and Judge Wade will be among the speakers.

Canadian Good Roads Association

The eighth annual convention of the Canadian Good Roads Association will be held in the Nova Scotia Technical College, Halifax, on May 10, 11 and 12, This convention will be known as the Maritime Good Roads Convention, being held in cooperation with the road associations of Nova Scotia, New Brunswick and Prince Edward Island. The annual meeting of the Canadian Automobile Association will be held in Halifax on the second day of the convention.

New Jersey State Highway Association

At the recent convention of the New Jersey State Highway Department at Trenton, employees of the department formed the New Jersey State Highway Association. Officers were elected as follows: President, Alexander W. Muir; First Vice President, William A. Johnson; Second Vice President, John L. Vogel; Third Vice President, T. W. Emmons; Fourth Vice President, G. R. Moore; Fifth Vice President, William T. McGovern; Sixth Vice President, Harry D. Robbins; Secretary-Treasurer, Edward O'Brien.

PERSONAL MENTION

D. C. Elder has been appointed county engineer of Marshall County, Iowa.

W. L. Hoffeditz has been appointed city engineer of Colorado Springs, Colo.

R. D. Tripp was recently appointed road engineer of Emmett County, Michigan.

A. G. Wulff has been appointed representative of the Highway Iron Products Co., for the Cincinnati district.

C. C. Widner, formerly City Engineer of Bozeman, Mont., has associated with C. A. Truitt to engage in consulting engineering.

Clarence M. Brooks has resigned as division engineer of the New Hampshire State Highway Department to become highway commissioner of Vermont.

Charles F. Puff, Jr., has resigned his position in the Philadelphia Bureau of Highways to become secretary and general manager of the Associated Highway Contractors of Pennsylvania, with headquarters at Harrisburg.

OBITUARY

F. C. Pearl, highway engineer, died on Jan. 10 at his home in Spokane, Wash.

F. C. Mieron, an engineer with the New Jersey State Highway Department, died on Jan. 19 at Lakewood, N. J.

William W. Edington, County Road Superintendent of Greene County, Indiana, died suddenly on Feb. 18 at his home in Bloomfield.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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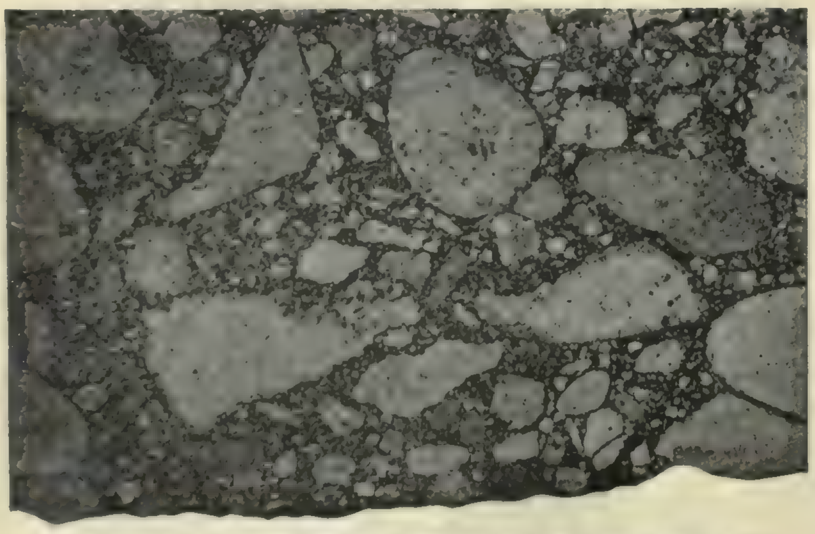

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Maintenance of Bituminous Roads*

Patching and Surface Treatment—Penetration and Mixing Methods of Preparing Patches—Materials and Methods Used—Methods of Application—Surface Treatments—Methods—General Maintenance

By GEO. E. MARTIN†

Roads constructed with bituminous materials or bituminous surface treated roads are best maintained by further applications of bituminous material. The bitumen used for maintenance need not necessarily be of the same type as that used for construction. The work of maintenance may be divided into two general classes, patching and surface treatments. Patches may be made by the penetration or by the mixing method.

In making penetration patches the hole should be thoroughly cleaned out and filled with clean, hard stone. The size of stone will depend somewhat upon the depth of the hole, but will usually range from 1 to 2 in. The stone is tamped or rolled thoroughly and hot bitumen applied at the rate of ¾ gal. per square yard is applied. A light cover of ½-in. stone to fill the voids is spread over the surface and tamped or rolled. The excess of ¾-in. stone is swept off and a seal coat of ½ gal. of bitumen per square yard is aplied. A light cover of ½-in. stone chips is rolled into the patch. The seal coat should be omitted if a surface treatment is to follow the patching. When properly and carefully done, this makes a very satisfactory patch.

Mixed patches may be made by either the hot mixed or the cold mixed method. Excellent patches can be made by the hot mixed method, but proper machinery and skillful workmen are necessary. In general this type of patching is economical only in cities having sufficient yardage of bituminous concrete pavements to justify the operation of a mixing plant. Both tars and asphalts have been used as hot bituminous patching material, with satisfactory results.

Bituminous material for cold mixed patches is in the form of emulsions or cut-backs. Emulsions are

PATROL GANG WITH MOTOR TRUCK MAKING A COLD MIXED PATCH

LARGE PATCH MADE IN ROAD WITH COLD MIXED CUT-BACK TAR made by mixing bitumen with water, soap and caustic soda so that the combination is liquid at ordinary temperatures. If the emulsion freezes it separates and cannot be recombined. Asphalts are usually used in making emulsions. Cut-back materials are made by thinning a tar or asphaltic binder with the proper solvent. The material is liquid at ordinary temperatures and is not affected by freezing. The solvents used are highly inflammable and serious fires may result if the material is used near an open flame. The material may also be spoiled if it is unduly heated. Tars are used for making a large proportion of the cut-back materials sold. Since cut-back materials tend to separate somewhat on standing it is best to agitate them before using.

---

*Paper presented at the seventh annual Road School of Purdue University.

†Highway Engineer, The Barrett Company.

In making cold mixed material for patches the materials may be mixed by hand, or preferably in a concrete mixer. Three parts of ¾-in. stone, one part clean, coarse sand, and from 15 to 20 gal. of bituminous material per cubic yard of the mixture will be needed. Just sufficient bituminous material to bind the stone and sand should be used. Somewhat less tar than asphalt is needed in the mixture. The exact amount of binder necessary must be determined by trial. The stone and the bitumen should be mixed until all the stones are coated and then the sand added. If hand mixing is used it will be necessary to turn the mixture seven or more times. About one minute mixing in a concrete mixer will give good results. If possible the mixture should be allowed to cure for several days before it is used. This allows some of the more volatile matter to escape and the mix will set up more quicklly when placed in the pavement.

The hole which is to be patched should be thoroughly cleaned out and the edges made vertical. If the hole is more than 2 in. deep it should be filled up to that depth with broken stone thoroughly tamped in place. The sides and bottom of the hole should be given a thin coat of the same bituminous material as used for the binder. This may be applied by means of a brush or broom. The hole is then filled with the cold mix, which is thoroughly tamped. If a surface treatment is not to follow the patching a light seal coat of the cut-back or emulsion is applied with a brush and covered with clean stone chips, sand or pea gravel. Best results will be obtained if the patch is allowed to set up a few days before traffic is permitted on it.

The patch should be closed up tight. If water is allowed access to the interior of the patch, it is sure to break up when the water freezes. The use of dirty or wet stone, or sand, or of too little bitumen, will produce a patch which has no strength and which will break up under the action of traffic. Too much bitumen will cause a patch to shove or roll.

Bituminous roads which are to be surface treated should never be used on untreated gravel or water-bound macadam roads unless a bituminous surface treatment is to follow the patching.

Both tars and asphalts are used in surface treating bituminous concrete and bituminous macadam pavements. The heavier materials must be applied hot. The cold material is easier to handle and an increasing amount of it is being utilized.

Bituminous roads which are to be surface treated should first be patched as described above, if patching is needed. Before the surface treatment is made the road surface should be thoroughly cleaned by sweeping. Bitumen should not be applied when the road is wet.

Bituminous concrete which is checked and cracked may be closed up by the application of about ⅛ gal. of cold refined tar per square yard. Enough coarse sand is used as cover to take up any excess of bituminous material.

The amount of bituminous material needed will depend on the condition of the road. The surface should be entirely covered, but money will be wasted if the bitumen runs out to the side of the road. Under ordinary conditions ½ gal. per square yard will be the maximum amount used, and more than that amount should not be applied at one time. If the proper type of bituminous material is used it will cut back and soften the original binder and add new life to the pavement.

Pressure distributors are most satisfactory for the application of these surface treating materials, although good work has been done by hand pouring followed by brooming. Horse-drawn distributors have also been used in some localities, although it is difficult to make a light application with them.

Surface treatments are covered with clean stone, slag or gravel of appropriate sizes. As a general proposition, as coarse a cover should be used as can be made to stay on the road. The use of too fine cover or improper bitumen will cause the formation of a mat on the surface of the road. This is almost certain to move under traffic. Rolling is not absolutely necessary, although it will produce a smoother job.

Bituminous roads are most easily and satisfactorily maintained by the repair of small breaks as soon as they occur, and the prompt application of surface treatments when needed. Neglect of these precautions will greatly incrase the maintenance cost and seriously reduce the efficiency and value of the road.

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The Province of Ontario, Canada, recently appropriated $7,000,000 for the construction of county and township highways.

A Bill Introduced in the Nebraska Legislature provides for the distribution of 75% of the state motor vehicle fees among the counties of the state.

Highway Legislation in New York

Appropriation Bills Calling for an Expenditure of $45,000,000 Are Introduced—Great Interest Manifested in Motor Vehicle Regulation

The New York State Legislature is running full steam ahead in the matter of turning out highway legislation. During the present session, up to March 14, bills have been introduced providing for the appropriation of $44,802,948 for highway improvement. The Hewitt Highway Bill, providng for the completion of the state and county highway system, involving the construction of 2,733 mi. of highway at a cost of $82,000,000, was signed by Governor Miller on March 1. Besides appropriation legislation, many administrative and regulatory measures have been introduced. The action of the Legislature on these measures will be watched with interest by the legislatures of other states, most of which are in session this year. Undoubtedly the tendencies in New York legislation will be reflected in the highway laws enacted this year in other states.

Appropriation Bills

No. 53, introduced in the Assembly Jan. 12 by Mr. Morrissey, provides for the reappropriation of the unexpended balance of $753,965 of a former appropriation for the acquisition of the Congress Street Bridge, Troy, between the Counties of Albany and Rensselaer, and making a further appropriation of $400,000 for the acquisition of the bridge. The money received by the counties will go towards the purchase of the bridge.

No. 98, introduced Jan. 19 in the Senate by Mr. McGarry, provides for the appropriation of $650,000 for improving as a state highway, the Queens Boulevard, Queens County, from Queensborough Bridge to the Nassau County line. This highway is not included in the Hewitt Law ultimate system of highways and, being situated in Greater New York City, the passage of this bill making this highway a part of the state system would be a new departure in highway policy.

No. 275, introduced in the Assembly by Mr. Leininger, provides for the appropriation of $500,000 for the acquisition of land and construction of a tunnel under Long Island Sound and the Harlem River to connect Astoria and Manhattan. The proposed tunnel would accommodate vehicular and pedestrian traffic.

No. 349, introduced Feb. 7 in the Senate by Mr. Hewitt, makes an additional appropriation of $5,000,000 for the construction of the New York-New Jersey vehicular tunnel under the Hudson River.

No. 899, introduced in the Senate on March 7 by Mr. Hewitt makes an appropriation of $1,934,676 for the contributions of the state to the counties for the construction and improvement of certain highways and county roads, in accordance with Secton 320-b of the highway laws.

No. 900, introduced in the Senate by Mr. Hewitt on March 7, appropriates $2,415,000 for contributions of the state for the repair and improvement of town highways and improvement of highways and bridges in Indian reservations.

No. 957, introduced March 8 in the Senate by Mr. Hewitt, provdes for the reappropriation of $330,592 of unexpended balances of former appropriations, for the purpose of construction and improvement of portions of state routes within several counties.

No. 958, introduced in the Senate on March 8 by Mr. Hewitt, provides for the reappropriation of $10,000,000 unexpended balance of funds provided in 1916 and 1919, to be used for the improvement of public highways.

No. 959, introduced in the Senate on March 8 by Mr. Hewitt, appropriates $5,250,000 as the state's share of construction and improvement of rural post roads with federal aid.

No. 960, introduced in the Senate on March 8 by Mr. Hewitt, makes available $10,000,000 appropriated in 1912 to be used in accordance with the recent Hewitt Highway Law.

No. 919, introduced by Mr. Hewitt in the Senate on March 10, makes an appropriaton of $7,500,000 for the maintenance and repair of improved state and county highways.

No. 1069, introduced in the Senate by Mr. Ferris on March 11, provides for an appropriation of $58,715 for highway improvement in Essex County, such sum being half of the unexpended balance apportioned to the county from the second state bond issue in 1912.

Motor Regulation Bills

Throughout the United States perhaps the chief interest in highway legislation centers upon the regulation of motor vehcles. Of the 52 highway bills introduced, 25 pertain to motor vehicles. If this interest of New York legislators serves as an index of the current of thought throughout the country, it becomes at once apparent that the legislation now being aimed at the motor vehicle should be framed by men fully cognizant of all sides of the problem. That this situation obtains is extremely doubtful.

No. 20, introduced on Jan. 12. in the Senate by Mr. Fearon, provides that signs regulating traffic must be within 15 ft. of the traveled part of the roadway and must have lettering 6 in. high.

(Continued on page 173.)

New York's $82,000,000 Highway Program

Governor Miller Signs Hewitt Law Providing for Improvement of 2,733 Miles of Highway to Complete State Highway System

With the signing of the Hewitt Bill on March 1 by Governor Miller, the State of New York will enter upon a great program of highway construction to complete the state system of highways, involving an expenditure of $82,000,000. Approximately 2,733 mi. of highways will be improved at a rate of construction of 450 mi. annually.

In accordance with a concurrent resolution of the State Legislature adopted April 18, 1919, a committee from both houses was appointed, with Senator Charles J. Hewitt as chairman and Assemblyman Warren T. Thayer as vice chairman, to investigate in reference to the highways to be designated for improvement in each county of the state containing towns, with moneys to be derived from federal apportionment and state appropriations. J. C. Finch was appointed consulting engineer of the committee.

Exhaustive efforts were made by the members of the committee to obtain the sentiments of the people and of the highway officials in the various counties of the state to ascertain which of the most important roads of the state were most in need of improvement. The committee visited nearly every county, inspecting roads and holding hearngs in various cities. During the course of these investigations, it became more and more apparent that a change should be made in the statutes relative to federal aid funds, such legislation to provide that in cases of roads other than state highways, the county in which the road may be located should bear a portion of the expense of improvement. Legislation to this effect was passed last year.

The concurrent resolution of the Legislature providing for the appointment of the above committee required the filing of a report by Feb. 15, 1920, but because the committee was unable to complete its work in such a short time, a concurrent resolution was adopted by both houses of the Legislature on Feb. 11, 1920, continuing the committee in all its powers and duties until Feb. 15, 1921. This resolution provided "that such committee shall prepare a map and plan for such system of highways and shall submit the same to the Legislature with its final report on or before Feb. 15, 1921, together with such legislation as may be needed to carry into effect its recommendations and completion of such system."

A very careful survey of the whole highway situation was made, according to the report of the committee, and it was found that in addition to the 10,300 mi. authorized by Chapter 462 of the Laws of 1917, of which 2,000 mi. were still unbuilt, approximately 700 mi. additional would be required to close up gaps and constitute a complete, connected system of highways embracing the most important and most extensively traveled roads, making a total of approximately 11,000 mi. which the committee felt should constitute the ultimate highway system of the state.

The field work was commenced May 17, 1920 with a hearing at Jamestown, Chautauqua County, and during the balance of the summer and fall hearings were heard in nearly every county. The findings have been embodied in a map showing an ultimate system of state and county highways of approximately 11,000 mi., of which 100 mi. are located on macadam roads improved by various towns and counties and which will need no extensive repairs for some time to come. (This map is a part of the law.)

Of the ultimate system mentioned above, aproximately 8,357 mi. are already constructed or under contract, leaving approximately 2,733 mi. to be improved, of which 855 mi. are located on state routes and 1,878 mi. on county highways. Of the unconstructed mileage, approximately 600 mi. have been designated as federal aid roads.

Assuming that the average cost of construction will be $30,000 per mile, says the report of the committee, it will cost to build the unconstructed portion of the proposed system, $82,000,000. Of this sum there are available the following amounts: From bond issues and under Chapter 891 of the Laws of 1920, $13,000,000; federal aid, $12,000,000; state appropriations to meet federal aid, $12,936,640; from the counties as their share of constructing 1,878 mi. of county highways, $14,000,000, making a total of $52,873,280 available for the work. This leaves $29,000,000 to be provided either by direct appropriations, bond issues or allotments of future federal aid appropriations.

It is estimated that construction can proceed at the rate of 450 mi. per year, thus requiring six years to complete the construction of the ultimate system of highways.

Chapter 840 of the Laws of 1920, commonly known as the Loman Act, provides for state aid to counties and under this law, construction of secondary roads will proceed rapidly, many counties having already appropriated funds with which to meet the state aid for 1921. Forty-eight counties have adopted the county system, a great many already owning road building equipment and employing experienced road builders.

The Hewitt Law provides eight complete and continuous routes across the state from east to west and 21 running north and south from the southern tier

(Concluded on page 180)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI MARCH 23, 1921 No. 12

MAKING HIGHWAY TRAVEL SAFE

An appalling number of accidents, many of them resulting in the loss of life, occur on American highways. Nearly all of them are avoidable. In fact, the number that could not be averted is too small to cause any real concern.

Prevention of highway accidents is possible, though difficult under existing conditions. It can be accomplished only by the cooperation of road makers, law makers and the operators of motor vehicles, especially the latter.

The road maker can do his part by, so far as possible, "building safety into the road," as someone once expressed it. This means, among other things, providing surfaces that, from the standpoint of safety, are the best; building adequate guard-rails where they are needed; superelevating and widening curves; building roads of adequate widths; removing obstructions to view at curves and at intersections; utilizing every possible means to reduce to a minimum the dangers at grade crossings; erecting needed warning signs.

All this work is needed—urgently. But it will avail nothing, without adequate, enforceable laws. Traffic must be regulated by law and the clearer and simpler these laws are, the more effective they will be. Their value will also be greatly enhanced by making those of the different sections as nearly uniform as possible.

Last, and most important, is the cooperation of the drivers of motor vehicles. An absolutely foolproof road cannot be built nor can even an ideal law protect the reckless driver or his victims. Better driving can be obtained only by strict licensing laws and by the infliction of severe penalties for reckless operation.

Road builders are doing their part as well as they can with the means at their command. Only public sentiment strong enough to find reflection in the making and enforcing of adequate laws can do the rest.

WORKMANSHIP IN PATCHING WORK

Good workmanship is an obvious essential to all road work. It is especially necessary in the patching work described in the paper on "Maintnance of Bituminous Roads," which is printed on other pages of this issue.

Of late the cold patch method has been very largely used. When applied to surfaces susceptible to repair by that method and put on by skilled workmen under competent supervision it has given satisfaction. Probably a large percentage of the so-called failures have been due to poor workmanship.

LOWER PRICES FOR ROAD WORK

Bids recently received by the Pennsylvania State Highway Department for the construction of over a hundred miles of roads were from 15 to 20% lower than bids for similar work last year, according to a report.

Such news as this should be very encouraging to road builders everywhere. While there have been no great decreases in the cost of road building materials, there has been a marked drop in labor costs and an increasing supply of laborers. Further decreases in wages seem likely and it is held in some quarters that material prices are bound to decline. Certainly if the condition in other lines can be considered a criterion, somewhat lower prices can be hoped for.

GOOD ROADS has contended all along that 1921 would be a record making year in road building. There is much to bear out that contention and little to indicate it is not warranted by the facts.

Pennsylvania Loses $35,000 of Motor Equipment in Fire

Fire on March 3 destroyed the garage of the Pennsylvania State Highway Department at Harrisburg. The loss is estimated at $35,000. Twelve trucks, six engines and considerable repair equipment was destroyed.

Highway Work in Washington

Total of $13,944,000 Was Available for 1920—Less than Half of it Expended—For This Year's Work the State Has $6,500,000

The State of Washington had $1,444,000 federal, $3,000,000 state and $9,500,000 county funds available in 1920, according to a recent statement from the State Highway Department. Less than half of the available funds was expended.

Counties in the state voted bond issues totaling $512,000 during the past year. Motor vehicle fees collected in 1920 totaled $2,800,000. For the present year it is estimated that the funds available to the state will amount to $6,500,000.

Lincoln Highway Progress

Over 85% Improved at Close of 1920—More Than 1,100 Miles Paved and Over 2,800 Miles Improved—$10,000,000 to be Spent in 1921

Of the 3,305 mi. of the Lincoln Highway between New York City and San Francisco, Cal., 2,853 mi. had been improved at the close of 1920.

According to a recent announcement from the headquarters of the Lincoln Highway Associaton, from which the foregoing figures and those which follow were taken, the total mileage at the end of 1913, was 3,389 and the improved portion embraced 1,598 mi. By the end of 1918, these mileages were 3,323 and 2,161 and by the end of 1919 the improved mileage had increased to 2,421, the total remaining the same as at the end of the previous year.

In a period of seven years, a total of $31,284,520 was spent on the highway and during the year of 1920 alone, 542 mi. of new construction were completed. This mileage was divided as follows: Permanent earth grade, 206.9 mi.; gravel, 187.8; concrete, 127.5; bituminous macadam, 12.2; brick, 7.1; macadam, 0.5.

The total mileages of various types of road on the highway on Jan. 1, 1921, were as follows: Graded gravel, 956.00 graded earth, 725.67; concrete, 422.34; bituminous macadam, 401.81; macadam, 287.10; brick, 219.68; natural earth, 136,00; asphalt, 78.00; natural gravel, 62.10; granite block, 7.10; creosoted wood block, 5.90; sand, 3.30.

Improvements to be made during the present year will cost approximately $10,000,000, according to the association's estimates.

Road Finances of Kentucky

There is now available through county and private subscriptions $2,107,405 for road work in Kentucky, making a total of about $40,000,000 available from this source, according to Joe Boggs, Commissioner of Public Roads. Other road funds total $7,118,573.

Maine Passes Law Providing for International Bridge

The State of Maine recently passed a law providing for the assumption of half the cost of constructing the proposed international bridge across the St. John River between Madawaska, Me., and Edmundston, N. B., Canada. The new bridge will form an important link in the route from Boston to Quebec.

Red Cross Will Build Road in China

The construction of a road linking two important cities in China has been undertaken by the American Red Cross, with the sanction of the Chinese Government, according to E. P. Bicknell, Acting Director of Foreign Operations. It is thought that this will be the best way of relieving famine sufferers in a province of Shantung, the territory allotted to the Red Cross for relief work. An appropriation of $500,000 was recently made by the Red Cross to be used in Chinese famine relief operations. Laborers employed in building the road will be paid in food supplies.

Highway Work in Ohio

Construction, Repair and Maintenance Contracts in 1920 Covered 3,612 Miles at Over $16,000,000—In 1921 Contracts Will Cover 4,000 Mles at $18,500,000

In 1920 the State of Ohio let contracts for the construction of 412,167 mi. of road, at a total cost of $12,866,119.89 and contracts for the repair and maintenance of 3,200 mi. of road at a total cost of $3,494,279.91, according to E. S. Smith, Chief Highway Engineer.

The total funds certified on contracts let in 1920 aggregated $13,695,359.72. For 1921 it is estimated that contracts will be let for 500 mi. of construction at $15,000,000 and 3,500 mi. of repair and maintenance at $3,500,000. On Jan. 1, 1921 there were 743.58 mi. of road under construction.

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During 1920, Georgia Constructed 114 mi. of paved road, 300 mi. of sand-clay road and took over 100 mi. of road for maintenance.

Lake County, Minnesota, will shortly sell $250,000 of bonds for road construction, according to a recent resolution of the County Board of Commissioners.

Tennessee Has Big Road Program

At a recent conference of the engineers of the Tennessee State Highway Department, W. P. Moore, Chief Engineer, stated that the department has approximately $9,000,000 of road projects under contract and that considerable additional work will be awarded early this spring.

Bill To Increase Motor Fees in Rhode Island

An act drafted by the State Board of Public Roads has been introduced in the Rhode Islalnd Legislature, providing for an increase of motor fees from 15 to 25% and raising the tax on private drivers from $1 to $2. Prvate chauffeurs will pay $3 and public drivers $5. Registration fees will be assessed at 25 ct. per horse power plus 25 ct. per hundred pounds total weight maximum capacity, figuring 150 lb. per passenger in the case of passenger cars. Vehicles with solid tires will be charged more than those equipped with pneumatics.

Spot lights are regulated and street cars are made subject to traffic rules.

Illinois Rejects Bids as Too High

Governor Small Orders Rejection of Bids, Saying State May Build Its Own Highways

Bids on 122 mi. of paving on the Illinois bond issue system received on Feb. 18, were rejected on March 5 by order of Governor Small because he considered the prices too high. Bids averaged $37,850 per mile in the northern and $44,250 per mile in the southern part of the state.

"If contracts were let for construction at that rate," commented Governor Small, "the people would get for the $60,000,000 authorized a system of roads covering less than 1,500 mi., instead of more than 4,000 mi., as they expected when they voted approval of this bond issue.

"The state must do something to secure roads for less money, and we will proceed to make a thorough investigation into the cost of all road materials and necessary machinery and equipment for the construction of hard-surfaced roads, to determine the feasibility of the state building its own roads or adopting some system of letting road work which will secure for the state every mile possible of road for the money expended."

Highway Legislation in New York

(Continued from page 169)

No. 23, introduced on Jan. 12 in the Senate by Mr. Fearon, makes a motor vehicle operator who negligently operates a car so as to injure a person, guilty of assault in the third degree.

No. 32, introduced by Mr. Simpson in the Senate of Jan. 12 provides additional penalties for violations of motor traffic laws.

No. 235, introduced in the Assembly by Mr. Martin, provides that motor vehicles must be equipped with lights to show whether the vehicles are moving or are stationary.

No. 254, introduced by Mr. Betts in the Assembly on Jan. 20, prohibits the use of cut-outs on country highways.

No. 261, introduced by Mr. Campbell on Jan. 20 in the Assembly, increases the counties' share of motor vehicle fees from 25 to 50%.

No. 123, introduced in the Senate on Jan. 24 by Mr. Lowman, provides that local speed ordinances are not to apply to state highways situated in sparsely populated towns and villages, or sections thereof. The State Highway Commission is to designate the location of the exempted sections.

No. 318, introduced on Jan. 25 in the Assembly by Mr. Trahan, provides that every motor vehicle owner must take out a $10,000 indemnity bond or insurance policy.

No. 241, introduced by Mr. Towner in the Senate on Feb. 1, provides that a motor vehicle owner, operating the machine only in the daytime, need not file proof in applying for registration that the machine is equipped with proper lights.

No. 477, introduced in the Assembly by Mr. Betts on Feb. 2, provides that trailers shall be considered as motor trucks so far as registration and number plates are concerned.

No. 345, introduced in the Senate on Feb. 7 by Mr. Campbell, provides that municipal motor vehicle operators shall not be required to take out state licenses.

No. 633, introduced in the Assembly on Feb. 10 by Mr. Brundage, provides that every motor truck or trailer over 6½ ft. wide and with capacity of 1 ton or more, shall have a green light on the left side, visible from the front after sunset and before sunrise.

No. 570, introduced by Mr. Cotillo in the Senate on Feb. 17, provides that motor vehicle owners shall file a bond or take out an insurance policy of $5,000. It is expected that legislation of this nature will be passed at this session.

No. 718, introduced Feb. 15 in the Assembly by Mr. Trahan, would amend the insurance law by requiring motor vehicle owners to file indemnity policies of $10,000.

No. 620, introduced Feb. 21 in the Senate by Mr. Straus, provides for compensation of personal injuries or death from operation of motor vehicles on the public highways. The State Industrial Commission would administer the law.

No. 727, introduced on Feb. 25 by Mr. Lowman in the Senate, increases automobile fees from 25 to 40 ct. per horse power; doubles the fee for license

(Concluded on page 178)

Massachusetts Highway Association

OFFICERS FOR 1921

HENRY V. MACKSEY, President	Framingham
JOHN M. McCARTHY, Secretary	Natick
CHARLES A. BROWN, Treasurer	Wellesley

VICE PRESIDENTS

ROBERT P. MARSH	Springfield
DAVID H. LIVINGSTON.	Dedham

Directors

JOHN A. GAFFEY	Medford
HENRY A. SPATES	Gloucester
WILLIAM P. HAMMERSLEY,	Norwood
FRED B. RICHARDSON	Brookline

Announcement

This section of the paper is open to members of the Massachusetts Highway Association for the discussion of matters directly connected with road interests. Members are requested to submit items of interest for use in this column.

Address all communications to GOOD ROADS, P. O. Box 2705, Boston

The annual meeting of the Massachusetts Highway Association was held at the American House, Boston, Thursday, Feb. 24, about 200 being present. This meeting was to be known as "Mayor's Day," but due to a severe storm and difficult conditions caused by snow, there were only a few mayors present.

The annual election took place and the following officers were elected for the ensuing year: President, Henry V. Macksey, Superintendent of Public Works of the Town of Framingham; Vice President, Robert P. Marsh of the Department of Streets of Springfield; Secretary, John A. McCarthy of Natick; Treasurer, Charles A. Brown, of Wellesley; Directors, John A. Gaffey and Henry A. Spates.

Retiring President James C. Blake, of Worcester, introduced President-Elect Macksey who thanked the members for their vote in electing him president of the association. The first speaker introduced, Mayor Eben O. Childs, of Newton, certainly lived up to his requirements as a convincing speaker and his story of the "'corner lot" was very much appreciated by the members. Mayor Childs spoke of the large federal tax turned in by the City of Newton in comparison with the small amount received, whch proved that the city of Newton was not the wealthiest city in the state. In closing he spoke at length of the necessity of hearty cooperation between the mayors, the board of governments and public works department officials throughout the state.

President Macksey then introduced Mayor Bradford, of Quincy, who admitted himself that he was not much of a road builder, yet he was very well posted on the ancient Roman roads. Mayor Bradford informed the gathering that he was past president of the Master Builders' Association, and his talk on plumbing and schoolhouse work was very interesting. One of the great troubles in Quincy at the present time is unemployment, but this condition seems to prevail in most of the cities and towns in the state.

Mr. Macksey then read a bill, as submitted by the North Shore Superintendent's Association, known as Senate Bill No. 159, upon which there was a hearing held Mar. 3 before the Public Service Commission at Room 443 at the State House. (A copy of this bill follows this item.)

Mr. Prichard, of Somerville, was then called upon to explain the bill and he urged that all present attend the hearing. It was then voted that the secretary send a notice to all members of the Highway Association concerning this bill and the importance of their cooperation in securing its passage.

The next speaker was Councillor James A. ("Jerry") Watson and in the course of his remarks he told a story of his flivver being stuck in a Newton road, to which Street Commissioner George E. Stuart took exception. During this discourse "Jerry" was presented with a "Quincy cigar" by Mayor Bradford for being the best snow shoveler in the City of Boston. Beacon Hill, the plans for Station 2 and Edison Electric Illuminating Company and other matters of local interest were referred to by Councillor Watson during his speech.

The superintendent of streets of Gloucester informed the members that Gloucester at the present time was not being troubled by trolley cars and, therefore, the snow situation in that city was far better than in previous years.

Ex-Mayor P. G. Holmes, of Worcester, was the next speaker and he informed the members of the importance of using every available effort to persuade the authorities at Washington to allot to the State of Massachusetts a larger portion of federal aid.

Michael Driscoll, Superintendent of Streets of Brookline, told the members of the conditions at the present time in Brookline regarding labor, etc.

The meeting adjourned at 3:15 p. m.

Senate, No. 159; An Act to extend the Civil Service Laws to Superintendents of Streets or Street Commssioners of Cities and Towns.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same as follows:

Section 1. The office of superintendent of streets or street commissioner of cities and towns, except Boston, shall hereafter be subject to the civil service laws and the regulations made thereunder.

Section 2. Present incumbents of said positions shall not be required to take any examinations if they have had not less then three years' experience in the position.

Section 3. This act shall be submitted to the voters of the cities and towns, except Boston, at the next state election on the official ballot used for the election of state officers in the form of the following question: Shall an act passed by the General Court of 1921, placing the offiice of superintendent of streets or street commissioner under the civil service be accepted?

If a majority of the voters of a city or town voting thereon vote in the affirmative, then this act shall take full effect, otherwise, it shall not take effect therein.

News and Gossip

The State Highway Commission has awarded the following contracts: To C. Bianchi & Co., concrete road at East Brookfield; to W. C. Tannatt, Jr., concrete road at Palmer; to Hinman & Rudiger, bituminous macadam road at Spencer and East Brookfield.

Abstract of bids for concrete pavement on Main Street, Gardner, Mass.

	BIDS RECEIVED		
	D. S. McGrath Adams, Mass.	L. B. Taylor Athol, Mass.	Fred T. Ley Co. Springfield, Mass.
1,875 cu. yd. excavation	$2.00	$2.35	$1.80
533 cu. yd. fill	0.01	1.60	1.74
2,397 cu. yd. concrete pavement	15.00	16.00	14.00
95,798 lb. steel 0.06 and 0.04 fabric	——	2.90 cwt.	0.0475
Total	$45,458.21	$46,389.19	$46,673.84

Mayor Quinn of Cambridge has submitted the annual budget to the City Council and has recommended a total of $4,533,515.13 instead of $4,945,937.61, as previously requested. This is a reduction of of $412,422.48 and is $15,814.51 less than the appropriation for 1920.

It is unfortunate that the proposed tax on motor trucks has been conceived as a means of "taxing them off the highway." Already the truck has established itself as an indispensable factor in transportation, of value alike to producer, merchant and consumer. To raise bars against it would be to block the wheels of progress. Yet it is equally evident that the truck tends to become a road destroyer, unjustly burdensome to the taxpayer. The situations calls for a candid review of the facts, a broad tolerance, and such measures of compromise as may lead to a far-seeing constructive program.

"Death Bridge" on Lowell St., Reading, closed last fall to motor traffic because of the frequency of fatal accidents on the treacherous curve it makes over the railroad tracks, has been reopened. But only blind men (and they don't drive cars yet) need fear "Death Bridge" longer. For a huge warning sign, bearing a small skull and cross bones has been stretched across the right of way at either approach. Beneath the death sign, emblazoned in monster letters, are the words, "Death Bridge for Careless Driver. Passable But Unsafe!" The signs are 10 ft. wide and 7 ft. deep. At night they are brilliantly illuminated, so that motorists have no excuse now for trying to take the bridge at 60 mi. an hour.

The following schedule shows the number of automobiles and motor trucks registered in five of the New England states:

State.	Passenger	Commercial	Total	Receipts from registrations
Maine	55,600	7,600	63,200	$820,000
Massachusetts	253,245	51,386	304,631	3,860,232
New Hampshire	30,240	4,440	34,680	542,457
Rhode Island.	40,768	9,563	50,331	451,062
Vermont	28,706	2,916	31,622	555,384
Total	408,559	75,905	484,464	$6,229,135

According to the annual report of R. C. Damon, Town Auditor of Ashby, which he has filed, this town did not owe anybody even as much as one cent at the close of the fiscal year and had a credit balance of $12,100.49. He further reports that the town has no liabilities.

Robert D. Andrews, a Boston architect, has written to the "Boston Transcript" to suggest a new Massachusetts Avenue Bridge. A part of Mr. Andrews' article is given below:

"There is a very widespread sentiment in the community that in some way the proposed war memorial, whatever its form, should be so placed as to minister to the beauty of Boston's water park, and, if possible, to contribute to the fulfillment of its purpose as a recreative feature in the popular life. Ultimately, the problem is one of scenic effect. The final end is to impress upon the imagination of all beholders the great value placed by the community on the devotion and self-sacrifice of its war-time heroes. This service is essentially an ideal one, Whatever form the memorial shall take, the expenditure will have been made in vain if the result fails to express in visible form the honor paid by a grateful country to its defenders."

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The Idaho Senate recently passed a bill repealing the 2-mill highway tax levy law enacted at the last session of the Legislature.

England has Nearly 25,000 Men at Work on road projects which have been laid out in different parts of the country for the relief of the unemployed.

New Hampshire Good Roads Association

OFFICERS FOR 1921

HARRY L SMITH, President	Lakeport
JERRY KILLORY, Secretary and Treasurer	Laconia
C M BROOKS, First Vice President	Keene
OZMAN W. FERNALD, Second Vice President	Berlin

Board of Directors

OVID F. WINSLOW.	Nashua
F. H COLBURN	Concord

The regular quarterly meeting of the New Hampshire Good Roads Association was held at Knights of Pythias Hall, Concord, on Thursday, March 10, about 75 members being present, including Governor Brown and Mr. Truesdell of the Governor's Council.

Motion was carried to send a letter of condolence to the family of the late Mr. Becker who was a member of the association.

The retiring president, Winfield M. Chaplin, of Keene, delivered an appropriate speech of thanks to the members for their hearty cooperation throughout the past year.

The following were appointed to count the ballots: Mr. French, of Laconia, Fred Purrington, of Concord and Mr. Pike, of Manchester.

Harry L. Smith of Lakeport was elected President, Jerry Killory of Laconia, Secretary-Treasurer. The following applications were received and acted upon favorably: George W. Tuttle, H. E. Langley, H. R. Cowper, R. A. Kenney, J. H. Johnson, Alvan E. Foss, H. E. Sargent, J. A. Whittaker, J. M. Eldridge, J. E. Normandeau, L. H. Wilkinson, C. A. Blake, S. A. Nims, S. C. Wilson, A. E. Wells, W. O. Scales and L. R. Rickett.

The first vice president was C. M. Parks of Keene, Directors: Ovid F. Winslow, of Nashua, and F. H. Colburn.

Governor Brown was then introduced to the members. He emphaszed the necessity of levying a heavy tax on the vehicle that did the most damage to the roads; and if principal wear is caused by motor trucks and heavy high speed passenger cars he is in favor of increasing the fee for these vehicles.

Mr. Truesdell, of the Governor's Council, was the next speaker, but instead of speaking about good roads and conditions in general throughout the Granite State, Mr. Truesdell entertained the gathering with several interesting stories.

Mayor-Elect Wilkinson, of Laconia, was the next speaker. He informed the gathering that he had come to the meeting to seek information rather than to make a speech. President-Elect Smith of Lakeport thanked the members for electing him to the high office of president of the association and asked for hearty cooperation during the ensuing year. Mr. Purrington, Chemical Engineer of the State Highway Department, read a very interesting paper on sand and described the various requirements for sand suitable for concrete construction.

Dinner was served by F. E. Colburn of Concord.

After dinner the meeting was opened to general discussion regarding the question of damage to the highways caused by heavy motor trucks and the necessity of increasing the registration fee. There is a bill now before the House of Representatives in Concord to establish a new rate on all vehicles, as follows: Pneumatic tires, 65 ct. per 100 lb. capacity; solid tires 85 ct. per 100 lb. capacity; iron tires, $1.00 per 100 lb. capacity.

Mr. Colburn, Assistant State Highway Engineer, called the attention of the members to the interesting methods emplolyed in the construction of the new bridge over the Piscataqua River at Portsmouth.

The meeting adjourned at 5:00 p. m.

Several bills of interest to road builders were moved forward toward enactment by the Legislature on March 2.

Baboosic Road, from Milford to Manchester, will become the Horace Greeley Highway when Governor Brown affixes his signature to the House bill passed by the Senate recently.

The Horace Greeley highway measure, house bill No. 312, was only one of a large number of bills to pass the senate.

There has been considerable difficulty in Manchester over a contract for the services of an expert in connection with the construction of the proposed Amoskeag and McElwain Bridges, and the last development was the passage of the following vote by the Manchester Board of Aldermen.

"Whereas, a certain contract, dated Jan. 13, 1921, was entered into between Moise Verette, Mayor of Manchester, and Michael F. Shea, then director of Public Works of the City of Manchester, with one Leo Bayles Reilly, describing himself therein as a consulting engineer, and that certain sums of money are claimed from said city, to be due under said contract and

"Whereas, it is believed by many citizens and officials of said city that the said contract is illegal and void, therefore, be it

"Resolved, that the city solicitor be and is hereby instructed to proceed without any delay to ask the court to determine the validity of said contract and the liability of the city of Manchester under the same.

"Resolved, That this board discountenances and strongly disapproves the action of His Honor, Moise Verrette, in his recent signing of the contract with an engineer for the supervision of bridge construction and in his intention to sign bridge construction contracts, calling for an expenditure far in excess of the sum appropriated for the purposes, and that this board also discountenances and strongly disapproves his action in incurring expense for the auditing of payments in connection with school buildng construction, without the authority from this board."

Some time ago a notice was posted by the Manchester Highways Department announcing that all wages paid by the department would be reduced 20% on Mar. 14 and that employees would be paid for time worked only, thus eliminating pay for rainy days and holidays.

President McShane of the City Employees' Union declared that the men could not exist on the new wage arrangement which was posted by the commission. By this reduction, which went into effect Mar. 14, the minimum wage is reduced from 62 ct. an hour to 50 ct. an hour and pay is given for time worked only. It is the contention of the union leaders that the cost of living has not been reduced in proportion to the slicing of pay which the commisson is making. That laborers whose work is out of doors do not average more than four days a week is another argument against the new ruling of the commission.

The union later held a lengthy meeting for the discussion of this subject and the men voted to report for work under the reduced wage, under protest.

The water commissioners have always maintained the same rate of wage as the highway department and the same reduction will be in effect for that department.

New York State Road Builders' Association

OFFICERS

JOHN H. GORDON, President,	Albany
C. J. HENDRICKSON, Vice President	Syracuse
WILLIAM G. FOX, Treasurer	Saratoga
M. F. DUGGAN, Secretary	Albany

Trustees

W A. GREENFIELD	Hornell
T. H. GILL	Binghamton
FRED E. ELLIS	Melrose, Mass.
W. T. THAYER	Chateaugay
JOS. McCORMICK	East Providence, R. I.
JOSEPH WALKER	Albany
S. B. VAN WAGENEN	Rondout

Legislative Committee

FRANK G. FOWLER, Chairman	Mt. Kisco
JOHN B. DOWER	Ballston Spa
H. B. HARRISON	Buffalo
JOS. McCORMICK	East Providence, R. I.
W. T. THAYER	Chateaugay
N. E. YOUNG	Union
S. B. VAN WAGENEN	Rondout

Membership Committee

RICHARD HOPKINS, Chairman	Troy
FRED E. ELLIS	Melrose, Mass.
W. A. GREENFIELD	Hornell
C. J. HENDRICKSON	Syracuse
J. F. PADDELFORD	Sherburne

Crusher Run

The New York State Road Builders' Association held its annual electon on Friday, Mar. 18. The following officers were elected:

President, for a term of one year, John H. Gordon, Albany, N. Y.; Vice President, for a term of one year, C. J. Hendrickson, Syracuse, N. Y.; trustees for three years, Wm. G. Fox, Saratoga Springs, N. Y., Louis Mayersohn, Albany, N. Y.

Both members and associate members of the association were present in large numbers and many matters of vital interest to all contractors were discussed and handled to the satisfaction of all present.

Commissioner Sisson informed a delegation of Guilderland residents that the construction of the Western Turnpike would be started early in 1922. This road will be one of the main links on the state highway to Buffalo. In order that there might be no delay in the construction of the road, Commissioner Sisson said that the road would be placed under contract late this coming fall.

Theron M. Ripley, of Watertown, N. Y., former Division Engineer at Hornell, N. Y., who was suspended by former Highway Commissioner Frederck Stuart Greene, has been reinstated by Commissioner Sisson, following the granting of a favorable decision by the Appellate Divison of the Supreme Court upon Mr. Ripley's application to compel his reinstatement.

Perry Filkin has been transferred to the Buffalo division office to make room for Theron M. Ripley. Squire E. Fitch, who has been serving as Division Engineer in Buffalo, N. Y., since the death of Charles J. McDonough last December, will return to his former position as superintendent of maintenance covering the western half of the state.

Commissioner Sisson has been requested by residents of the Altamont district to substitute concrete for bituminous macadam in the construction of the Voorheesville-Altamont Road, which will be 6 mi. long. Commissioner Sisson said that a macadam road could be built at a cost of $10,000 per mile less than the concrete one, and that a macadam road would be built this summer.

Highway Commissioner Herbert S. Sisson received proposals on Friday, March 18, for the construction of 95.04 mi. of highways in 18 counties. There were 22 roads in the letting. One, in Allegany

County, is a bituminous and concrete job, mostly bituminous. One in Cattaraugus County is mostly concrete, with a little brick; one in Clinton County is bituminous macadam. There is also a bituminous macadam road in Oswego County, and the other 18 roads are concrete roads. There are two repair contracts in Onondaga and Rensselaer Counties.

Highway Commissioner Herbert S. Sisson has appointed as his third Deputy William B. Reed of Weedsport. Mr. Reed succeeds Charles Van Amburgh, of Binghamton, at a salary of $5,000 a year.

Robert J. Moloy, who has been with the New York State Highway Commission for the past two years, has resigned his position and will take up his new duties as examiner in the New York office of the State Insurance Department. The employees of the Testing Bureau presented him with a gold pencil.

Commissioner Sisson recently inspected the construction work on the new bridge over the Rondout Creek. The bridge is expected to be ready for traffic the latter part of the year. The opening of the bridge to the public will be marked by a special ceremony at which it is expected to have Governor Miller and other state officials as guests of honor.

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Highway Legislation in New York

(Concluded from page 173)

plates; and increases motor truck fees to the following: 2 tons or less, $15; 3 tons, $22.50; 4 tons, $40, (Fees are based on the weight of the truck plus the carrying capacity.) The present fees up to 14 tons are doubled. The fee on the 14-ton truck is $140. Trucks in excess of 28,000 lb. are taxed $20 for each additional ton. Fees for trailers are similarly increased. This measure is aimed to "legislate the heavy truck off the road" and it is expected it will be enacted into law.

General and Administrative Bills.

No. 15, introduced in the Senate by Mr. Baumes on Jan. 5, raises the permissible bonded indebtedness of Orange County and removes the limitation of 5% interest rate on bonds of the county, it being provided only that the bonds of the county shall not be sold less than par.

The problems of too low a bonded indebtedness limit and too low an interest rate on bonds are common to many states and counties throughout this country at the present time and it is likely that other legislatures will consider similar legislation to avert retardment of highway construction.

No. 33, introduced on Jan. 12 by Mr. Hewitt in the Senate, designates the ultimate system of highways for the state. This bill has been passed by both houses, signed by the Governor, and now forms the highway program of the state. This law is treated in detail elsewhere in GOOD ROADS.

No. 25, introduced in the Senate on Jan. 12 by Mr. Walton, provides that counties may pay excess cost over available funds for federal aid roads.

No. 83, introduced in the Assembly by Mr. Greenwald on Jan. 12, provides that bridge construction and repair costs on a state highway shall be borne by the state and on a county highway one-half by both the state and county. All work to be done by and under the State Highway Commissioner.

No. 107, introduced in the Senate on Jan. 19, by Mr. Baumes, changes the present law by permitting towns to widen roads to a width of less than three rods.

No. 118, introduced in the Senate on Jan. 21 by Mr. Thayer, provides for the state to acquire at its expense toll bridges connecting a town and a county highway. (This bill failed last year.)

No. 206, introduced in the Assembly by Mr. Cosgrove on Jan. 19, authorizes New York City to construct a vehicular tunnel under New York Bay to connect Manhattan and Richmond County.

No. 216, introduced in the Senate by Mr. Pitcher on Jan. 31, authorizes the state highway commissioner on request of supervisors of a county of more than 81,000 and less than 83,000 inhabitants, (Jefferson County) to determine whether a road forming a shorter connection between two points on a state route shall be maintaned by the state as a state highway.

No. 948, introduced on March 8 in the Senate by Mr. Thompson, authorizes the state highway commissioner to take necessary right of way on state forest lands to construct state and county highways and to use local materials. This will enable the Highway Department to construct a state highway in the Adirondack preserve.

No. 956, introduced by Mr. Lowman in the Senate on March 8, provides that counties having assessed valuations of over $150,000 for each mile of highway therein, shall receive county aid not to exceed 1/50% of the assessed valuation, nor more than $100,000 annually.

No. 992, introduced by Mr. Lowman in the Senate on March 9, provides that the cost of eliminating grade crossings on federal aid highways shall be borne, 50% by the railroad, 25% by the Federal Government and 25% by the state. In reconstructing a federal aid road, 50% of the cost shall be borne both by the state and the Federal Government.

No. 1043, introduced in the Senate by Mr. Hewitt on March 10, provides that county and town roads constructed in accordance with Chapter 30 of the Laws of 1909 may be taken over by the state as state or county highways.

MEETINGS

Calendar of Coming Meetings

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12.—Canadian Good Roads Association.—Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

Conference of Iowa Road Officials

The 8th Annual Conference of Iowa Road Offiicials will be held at Ames, Iowa, on Wednesday, Thursday and Friday, March 23, 24 and 25, as has been noted in these columns. It will be open to county supervisors, county auditors, county engineers and assistant county engineers.

Wednesday forenoon will be devoted to registration and the formal opening of the conference, the presentation of papers beginning at the afternoon session. The meetings will be held in Engineering Hall of the Iowa State College.

The papers scheduled for the afternoon session on Wednesday are: "1920 Accomplishment in Road Building," by F. R. White, Chief Engineer of the Iowa Commission; "Primary and Secondary Road Assessments," by C. R. Jones, followed by a discussion led by R. E. Robertson, County Engineer of Cerro Gordo County and Jos Wagner, County Auditor of Scott County; and "Road Administration from the County Standpoint," by H. C. Meyer, Supervisor of Hancock County, followed by a discussion led by J. K. Hilton, Engineer of Wright County.

Three papers are scheduled for Wednesday evenings, one for engineers, one for auditors and one for by Wm. Collinson, Member of the State Highway Commission; "Contractors' Methods in Building Iowa Concrete Pavements," (Illustrated) by Henry W. Horst, President of the Henry W. Horst Co., and "Economic Problems in Contracting," by Stanley Moore, Chairman, Highway Section, Associated General Contractors of America.

On Thursday forenoon there will be three meetings, one for engineers, one for auditors and one for supervisors. At the engineers' meeting papers will be presented as follows:

"Field Inspection of Steel Spans," by E. W. Blumeschein: "Design of Wings on Skew Bridges and Culverts," by J. A. Paulsen; "Effects of Shale Pebbles in Concrete and Removal of Shale from Gravel," by F. H. Lang, Engineer of Tests, Minnesota State Highway Department, followed by a discussion led by P. J. Preston; "Recent Developments in Load Increases," by A. H. Fuller, Professor of Civil Engineering, Iowa State College, and Consulting Road Engineer, Iowa State Highway Commission; "Pavement Failures," by T. R. Agg, Professor of Highway Engineering, Iowa State College, and Consulting Road Engineer, Iowa State Highway Commission.

The program for the afternoon meeting on Thursday includes the following: "Railroad Crossing Improvements," by J. H. Ames; "Inspection of Bridge Materials," by A. D. Finch, Engineer of Fayette County, followed by a discussion led by C. W. Eby, Engineer of Lucas County, and Berty Myers; "Road Drainage," by F. T. Sheets, Engineer of Design, Division of Highways, Illinois Department of Public Works and Buildings, followed by a discussion led by A. H. Cunningham, Engineer of Buena Vista County, and W. F. Beard; "Road Progress in Neighboring States," by Geo. L. Campen, Senior Highway Engineer, U. S. Bureau of Public Roads.

On Thursday evening there will be an entertainment and the annual banquet.

The program for Friday forenoon includes papers as follows: "Maintnance of Gravel Roads," by J. T. Donaghey, Maintenance Engineer, Wisconsin State Highway Commission, followed by five-minute discussions by G. P. Goplerud, Engineer of Mitchell County, and J. F. Reynolds; "The Proper County Organization for Primary Road Maintenance," by A. F. Fischer, Engineer of Johnson County, followed by five-minute discussions by L. B. Stephenson and A. Kool, Supervisor of Marion County; "Care of Equipment," by W. P. Rawn, Engineer of Washington County, followed by five-minute discussions by C. D. Forsbeck, Engineer of Montgomery County, and F. H. Mann.

On Friday afternoon, there will be three papers, as follows: "Selection of Pavement Type," by Clifford Older, Chief Engineer, Division of Highways, Illinois Department of Public Works and Buildings; "Engineering Cost on Primary Road Work," by H. K. Davis; "Utilization of Iowa Gravel in First Class Pavements," by R. W. Crum.

Conference of Ontario Road Officials

The seventh annual conference on road construction for county road superintendents and engineers of Ontario, Canada, was held at Toronto on March 1 and 2, under the auspices of the Ontario Highways Department. About one hundred were in attendance and the meeting was one of the most successful ever held.

Papers and talks on various phases of highway work were given, among which were, "Drainage Laws as Related to Highways," by W. G. McGeorge, County Engineer of Kent County; "Bridges and Culverts," by Arthur Sedgwick, Assistant Engineer, Ontario Highways Department; "The Transportation and Handling of Materials," by A. M. Jackson, County Engineer of Brant County; "Road Accounting," by K. W. McKay, County Clerk of Elgin County; "Maintenance of Stone and Gravel Roads," by William Watters, County Road Superintendent of Lanark County; "Beautification of Highways," by H. J. Moore, Forester of the Ontario Highways Department.

The last session of the conference was held in conjunction with the Ontario Good Roads Association.

PERSONAL MENTION

B. W. Benedict has resigned as city engineer of Lockport, N. Y.

J. O. Corwin, Jr., has been appointed engineer of Travis County, Texas.

Charles Smithley has been appointed county engineer of Geary County, Kansas.

Miss Esther M. Jack, City Engineer of Williston, N. D., is president of the North Dakota Society of Engineers.

C. J. Welch, Assistant General Sales Manager of the United States Tire Co., has been elected a director of the company.

H. G. Shulde has been appointed district engineer, with headquarters at Bedford, by the Pennsylvania State Highway Department.

Clarence B. Myers has resigned from the Pennsylvania State Highway Department to become assistant engineer in the Philadelphia Bureau of Highways.

A. T. Rhodes, formerly Street Commissioner of Worcester, Mass., was recently appointed representative of the Austin-Western Road Machinery Co. in the New England district.

C. R. Thomas has been appointed editor of the "Professional Engineer," the official organ of the American Association of Engineers. Mr. Thomas was at one time editor of "Successful Methods" and associate editor of "Engineering and Contracting."

* * *

New York's $82,000,000 Highway Program

(Concluded from page 170)

of counties to the Mohawk Valley. It also provides 60 connections with adjoining states and the Dominion of Canada. Accordingly, when this system is completed, it will be possible to enter the state on any one of these 60 highways and leave on any one of these connections without traveling on a single mile of unimproved highway. Provision has also been made so that the Catskill region will be opened up from every direction, and, for the first time, entrances have been provided to the great Adirondack Forest Preserve from the south and west.

Fifty routes on the state highway system are designated for improvement, as follows: New York to Albany; New York to Valatie; Orangetown, Rockland County, to Albany; West Point to Westfield; Kingston to Mohawk; Albany to Buffalo; Binghamton to Albany; Binghamton to Kirkland; Waverly to Bouckville; Syracuse to Afton; Ithaca to Auburn; Horseheads to Lyons; Horseheads to Ithaca; Painted Post to Rochester; Hornell to Rochester; Cuba to Le Roy; Scott, Cattaraugus County to Buffalo; Pennsylvania line at Chautauqua County to U. S. military reservation at Niagara River; Buffalo to Batavia; Elbridge to North Tonawanda; Rensselaer to Pittsfield; Riparius, Warren County, to Canadian lne at Clinton County; Ilion to Speculator; Fonda to Tupper Lake; Carey Corners, near Utica, to Albany; Herkimer to Trenton; Alder Creek, Oneida County, to Ogdensburg; Utica to Union Square; Rome to Oneida; Rouses Point to Niagara Falls; Malone to Jay; Lawrenceville to Ogdensburg; Syracuse to Colosse; Oswego to Syracuse; New York to Quogue; Owego to Seneca Falls; Little Falls to Saratoga Springs; Ballston Lake to Grand Gorge; Cobbeskill to Madison; Port Jervis to Kingston; New York to Connecticut line at Westchester County; Schenectady to Massachusetts line near Berlin; Mount Morris to Letchworth Park; Clifton Park, Saratoga County, to Saratoga Springs; Watkins to Interlaken; Canisteo to Wellsville; Catskill to Grand Gorge; Troy to Schroon Lake; Carthage, Jefferson County, to Antwerp; Fargo, Jefferson County, to Clear Lake Junction.

Highways in the various counties have been selected for improvement to receive state aid, 65% being paid by the state and 35% by the county.

The Hewitt Law took effect immediately.

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Concrete Roads must be reinforced

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JAMESTOWN, N. Y., MARCH 30, 1921

Number
13

Subgrade Testing Apparatus Used by Illinois Highway Department

Description of Apparatus and Methods Used on the Bates Experimental Road in Studying Subgrade Conditions and Behavior of the Pavement

By H. F. CLEMMER*

The object of the subgrade investigation as carried on by the Division of Highways of the Illinois Department of Public Works and Buildings in connection with the Bates Experimental Road was twofold: First, information was desired as to the uniformity of the subgrade under each of the 63 sections comprising the road, so that proper comparisons of the resistance of the various types of surfaces could be had; and, secondly, an excellent opportunity was afforded by whch valuable data on subgrade conditions, including expansion, contraction, bearing power and moisture content, so essential for

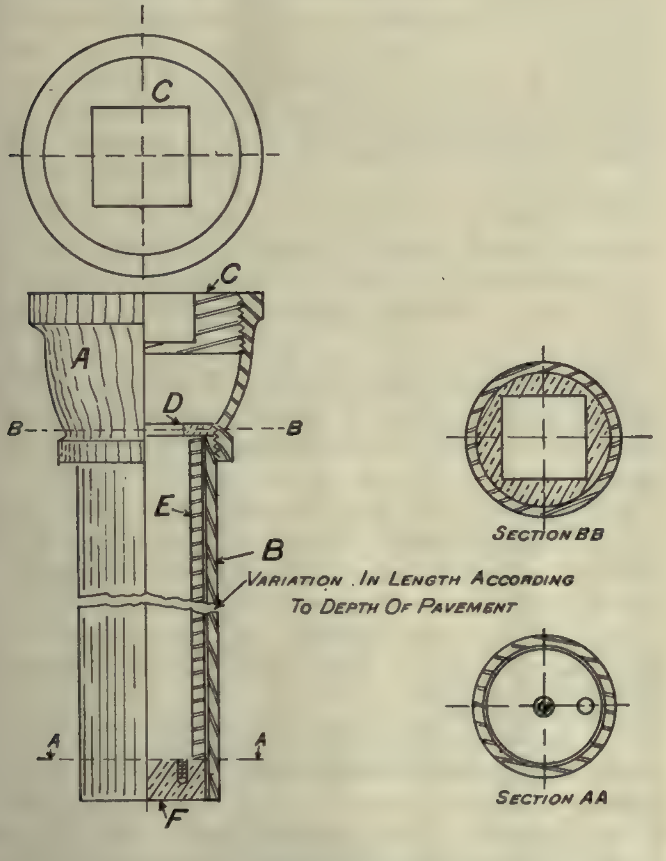


PLATE I-A.—DIAGRAM OF SUBGRADE TESTING CYLINDER

PLATE I-B.—SUBGRADE TESTING CYLINDER PARTS

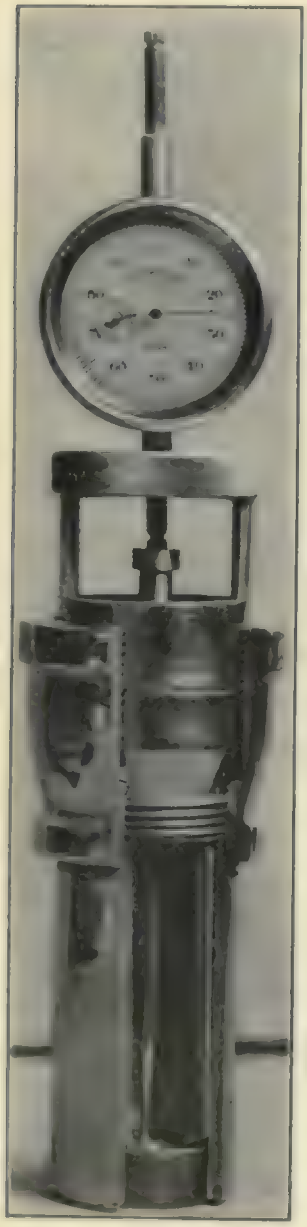
the comprehensive design of roads, could be had. This investigation includes determination of moisture content of soil as well as observations with pressure cells, subgrade testing cylinders, and static and impact bearing power determinators. In addition to the above, the effect of subgrade conditions upon the elevation of the road surface is beng studied by means of precise levels.

---

*Testing Engineer, Division of Highways, Illinois Department of Public Works and Buildings.

Subgrade Testing Cylinders

The subgrade testing cylinder as shown by accompanying Plate 1 consists of a 1½x1¼-in. black iron reducer (A), a short length of 1¼-in. black iron pipe (B), a 1½-in. countermark black iron plug (C), a special ¼x1¼-in. brass bearing plug (D), a short sleeve of 1-in. black iron pipe (E) and a ½x1¼-in. brass disk (F). Plug (C) is flush with top of the pavement and plug (D) rests freely on the subgrade. The length of the pipe (B) and sleeve (E) vary with the thickness of the pavement in which the cylinders are used.



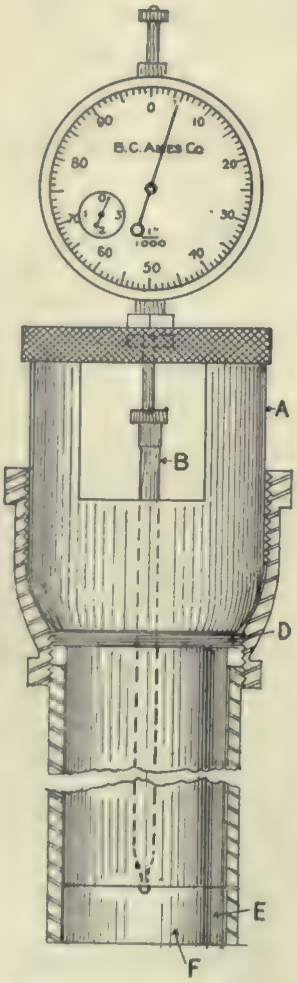


PLATE II.—PHOTOGRAPH AND DRAWING OF DEVICE FOR READING CHANGE OF POSITION OF BEARING PLUG.

When it is desired to install testing cylinders in a concrete pavement at the time of the construction of the pavement, wooden cylinders, 3 in. in diameter and about ½ in. less in length than the thickness of the pavement, are set in place before the concrete is poured. After tamping and finishing of the surface have been completed, the testing cylinders are substituted for the wooden ones, having the concrete tamped firmly around them, with their tops flush with the top of the pavement.

Installation of these cylinders in bituminous concrete and brick pavements can be effected by the use of the Calyx core drill after completion of the pavement. Considerable care must be exercised when grouting around cylinders so that proper contact with adjacent pavement can be had.

Operation of Apparatus

The brass bearing plug (D) follows the downward movement of the pavement and the upward movement of the subgrade, so that any separation between the subgrade and the bottom of the pavement, due either to rutting caused by traffic or occasioned by moisture or frost conditions, can be learned by measurements taken from this plug.

Device for Reading Change in Position of Bearing Plug

The device for reading the change in position of the bearing plug in relation to the pavement is shown in Plate II. This device consists of an Ames dial fastened in a support (A) which rests on the stationary brass disc (D) and a rod (B) which fits into a small circular depression in the center of the bearing plug (F).

The difference between initial readings, taken as soon as possible after the testing cylinders are placed, and readings taken at subsequent times shows any change in position between the subgrade and the pavement.

These bearing plugs can also be used to obtain data on bearing power of subgrade by loading them with the plunger of the static bearing power determinator.

By removing the brass bearing plug and iron sleeve, these cylinders afford an excellent means of obtaining subgrade samples for moisture content determination. Also the brass plugs in the cylinders give excellent points for securing precise levels so that the amount of heaving or settlng of pavement can be determined.

The testing cylinders are set in rows of three and five across the pavement, the rows being 25 ft. apart. When five cylinders are set in a row they are spaced in the center, at the quarter points and 18 in. from the edges, and when three are used, the ones at the quarter points are omitted.

Current Highway Legislation—I

Lawmakers in Various States Consider Measures Relating to the Organiation of Highway Departments and Financing Road Work

Most of the state legislatures are in session this year and are busily engaged with the problems of their respective territories. A problem common to all the states is that of highway development and its corollary, motor vehicle regulation. Many of the states are setting out to develop efficient highway systems and the legislators of these states are attempting to shape the course of this development. With the immense amounts of funds available for road improvement, highway legislation is now of supreme interest and importance. The following bills are in addition to those previously noted in GOOD ROADS.

Arkansas

The House Committee on Roads and Highways on Feb. 18 refused to sponsor the bill proposed by Governor McRae providing for the abolition of the State Highway Commission and the appointment of a state highway engineer with extensive powers.

On March 9 the House passed a bill appropriating $300,000 annually for 1921 and 1922 as state aid for highway construction.

The biennial highway appropriation bill, calling for $810,000, which originated in the House, was passed by the Senate on March 10.

Illinois

The Illinois Senate on March 5 tabled indefinitely a bill providing that poll and land taxes may be worked out on township roads.

Governor Small will recommend legislation to amend the civil service law so as to remove the Bureau of Highway employees from its scope.

Indiana

On Feb. 18 two bills were introduced in the Senate, one providing for the abolition of the State Highway Commission and the other for the turning back of motor fees to the counties.

Senator Southworth on Feb. 19 introduced a bill providing for the distribution of motor fees to the counties in accordance with the mileage of paved roads.

Maine

A bill has been introduced in the Maine Legislature providing for a highway commission composed of three members with terms of six years, with salaries of $7,000 for the chairman and $6,500 for the other two.

Representative Potter on Feb. 28 introduced a bill giving the State Highway Commission authority over all steel and iron highway bridges in the state. The commission, it is provided, can make repairs to bridges if a city, town or county fails to repair them. charging the expense to the territory's authorities.

Minnesota

A bill providing for the construction of a state highway system, involving an expenditure of $10,000,000 a year for ten years, passed the House on Feb. 18. This bill provides for the appointment of a single highway commissioner. When ths bill came to the Senate, it was found that there was no specific mention of a fund for salaries of the highway commissioner and his assistants. This may mean that a special appropriation bill will be necessary.

Missouri

Although the State of Missouri authorized a large road bond issue at the last general election, little has been accomplished in the way of legislation to carry out provisions of the amendment authorizing the issue, as recently pointed out in GOOD ROADS. A bill introduced in the House providing for the appointment of a committee to study highway organization in other states, was tabled indefinitely.

New Jersey

A bill has been introduced by Assemblyman Downs which provides for a $60,000,000 bond issue to complete the state highway system, to be ratified by referendum vote. The bonds would be issued at a rate of not more than $10,000,000 annually and would bear not more than 6% interest. One-fourth of the motor vehicle fees would be used to pay interest and principal, and if not sufficient, the deficit would be met by a direct state tax.

Senator White has introduced a bill calling for the appointment of a single state highway commissioner at a salary of $15,000 per year for a term of three years. The bill also provides for the appointment of a state highway engineer at $10,000 and three division engineers at $6,000.

In the report of the Motor Traffic Commission submitted to the Legislature, it is recommended that motor vehicle fees be increased approximately 30%. Weight limitation is placed at 30,000 lb. For passenger cars the proposed fee would be 40 ct. per horse power up to 30 hp. and 50 ct. per horse power for all cars over 30 hp. The minimum truck fee would be $10 and the maximum, $78.

Ohio

A complete reorganization of the State Highway Department, removal of all division engineers from civil service and increasing the salaries of important positions in the department are provided for in bills

(Continued on page 186)

Maintenance of Earth Roads*

Over 2,000,000 Miles of Earth Roads in the United States — Their Maintenance to be of the Most Vital Importance for Many Years to Come—Proper Drainage a Prerequisite to Proper Maintenance of Earth Roads—Crown—Periods of Intensive Maintenance—Methods

By C. C. ALBRIGHT†

From the U. S. Bureau of Public Roads we learn that there are in the United States, 2,500,000 mi. of public roads. About 300,000 mi. have been surfaced. Indiana has approximately 84,400 mi. of roads, of which 34,500 mi. have been surfaced. The improvement of roads during the past ten years has been accelerated over previous periods but has not exceeded 5% of the total.

From these figures it is readily seen that the greater part of the mileage of Indiana roads as well as the roads of the United States consists of earth or native top soil. It is, therefore, evident that for many years the maintenance of earth roads must occupy a prominent part in any scheme of road improvement.

It is unnecessary to enlarge upon the necessity of a personal interest in this problem, because, as intelligent citizens of this great state, we are aware of the direct economic and social benefits to be derived from a general improvement of our transportation system.

In order to bring these conditions more clearly before us, however, I will give a simple illustration, as follows: The tractive force required to pull a load on a common farm wagon over unimproved roads is from 100 to 300 lb. per ton of load. The average is 200 lb. per ton. It has been demonstrated that this can easily be reduced to one-half the value by a properly maintained surface. A very low estimate for this improvement is 5 ct. per ton-mile. Assume a light traffic of 50 ton-miles per day for 300 days per year and the saving is $750 per year. As the traffic increases the saving increases. With interest on money at 5% these figures would justify the expenditure of $15,000 for permanent improvement. Pennsylvania, Wisconsin and other progressive states maintain their earth roads in excellent condition for $100 to $150 per mile per year.

The maintenance of earth roads cannot be properly undertaken without some knowledge of soil conditions. In Indiana these vary from the light shifting sand and sandy loam of the northern and northwestern part of the state to the heavy clay of the Maumee Valley, the black soil of the central western part and the clay of the southern part. All require somewhat different treatment.

Proper drainage is the fundamental basis of all maintenance, as well as all construction work. No road can be kept in good condition unless provision is made for the elimination of all excess moisture. In the sandy soils just mentioned this is easily accomplished, while particular care must be exercised to secure favorable results with clay or gumbo soils.

If the road is sandy, a flat crown and light side ditches will usually suffice. In a clay soil the side ditches should usually be 18 in. or more below the crown of the road. This figure wil vary with the steepness of grade of the transverse and longitudinal drains, and the width of road. It may be desirable at times, when the road is located on a steep hillside, to put in tile drains on the upper side to intercept ground water flow. In all cases, rainfall and excess moisture should be carried from the traveled way as rapidly as conditions will permit.

The crown of a road in heavy soil should be from ½ to 1 in. per foot. The speaker, from personal observation covering a wide range of conditions, favors a value of not more than ¾ in. The crown should be carried as a smooth surface to the ditch line. An inferior road will invariably result if a false ditch is formed between the roadway and berm.

Assuming that the road has been properly drained and shaped, the next step is the actual maintenance of the surface. There are usually two main periods of intensive maintenance, viz, early spring, just after the frost leaves the ground, and the fall, just before the final freeze-up.

Immediately after the frost has left the ground is the time for the grader. This should be used to form a new well defined ditch. At this time also extra earth should be moved to the road surface in order to furnish material to fill ruts and depressions. While the road is soft and moist it will unite with the original material to form a new surface. All sod and loam should be removed from the road, as otherwise they form a prospective point of failure. These materials can be used to fill low places along the side of the road or hauled to adjoining farms as fertilizer. No loose material should be placed on the road after it has become thoroughly dry and settled, as it will only be stirred up as dust by the vehicles in dry weather and will form a slop after a rain.

The next step is to grade and shape the surface. This may first be accomplished by the steel blade

(Concluded on page 186)

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*Paper presented at the Seventh Annual Road School of Purdue University.

†Professor in Charge of Highway Engineering, Purdue University.

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Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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SOME TENDENCIES IN CURRENT ROAD LEGISLATION

Floods of highway laws, good, bad and indifferent, are pouring into the legislatures of many of the states—as is the normal thing at this time in a legislative year. A few of them are the results of careful studies of conditions made by road experts and financial authorities. Some are merely measures of only local importance—and not much of that. Some are purely political in their import and more useless than harmful. And there is the usual proportion of bills introduced by individuals with axes to grind and of proposed laws designed to raid the public treasuries.

This year's crop of measures exhibits perhaps even a greater tendency than usual towards the reorganization of state highway departments. Where the present commission consists of three or more members, there is always someone who believes that one commissioner would be better; and where existing laws provide for a single commissioner there is bound to exist a feeling that too much power is vested in one man and that the crying need of the commonwealth is a commission of at least three members. New Jersey is a case in point. Years ago the road work of that commonwealth was administered by a state highway commissioner. A few years ago there was a political upheaval and there was established a commission of eight members. Now there is a bill in the Legislature providing for a single commissioner. Other states have followed similar courses.

Another notable tendency is that towards the making of large bond issues to meet the cost of road betterment. When the proper financial provisions are made and when the funds secured from the issues are properly expended, this is an eminently proper method of raising funds. As a generality, the statement that bond issue funds should not be used for work having a life less than the term of the bond is correct. But in a modern high class pavement, there is comparatively little of the construction that will not last much longer than the term of the bonds.

Among the most admirable feature of the current legislation is the trend toward higher salaries for engineers. Like most other salaried workers—in fact, like most workers except those who work chiefly with their hands, those who are organized and those belonging to classes large enough so that their votes are factors in party politics—highway engineers have not been granted increases in remuneration anywhere near commensurate with the increases in costs of the necessities of life. There seems to be a growing—even though belated—realization of the fact that even the laborer in the highway engineering field is worthy of his hire.

A somewhat curious phase of recent legislation is in the nature of what might be called a "throwback" to the primitive. The "working out" of road taxes is a method that long ago fell into disuse, yet attempts to revive it still persist. The Illinois Senate is reported to have tabled a bill providing that poll and land taxes may be worked out on township roads; the Texas House has passed a bill fixing a penalty for failure to work out or pay road taxes, and an Alabama county is reported to have laid a $10 annual road tax that may be "worked out."

Of particular interest to users of motor vehicles are the efforts being made in a number of states to increase motor license fees. New York is a conspicuous example of this, though by no means the only one. In that state the proposal is meeting determined opposition, as it is in others. In some cases, the increases in truck fees are frank attempts to "legislate the trucks of the roads."

The most unfortunate thing about all the pending legislation is that very little of it will be effective this season. Where highway departments are reorganized, or where other sweeping changes are made by the laws, the new machinery of administration can hardly be expected to function efficiently soon enough to accomplish much during the coming season.

Indiana Passes License Law

On March 10 the Governor of Indiana signed the engineers' license bill passed by the Legislature. This law is similar to the model law drafted by the Engineering Council.

Oklahoma State College Establishes Highway Engineering Courses

The Oklahoma Agricultural and Mechanical College, Stillwater, has established a four-year course in highway engineering and a short course to be held during the winter months for the benefit of those already engaged in highway work.

The Maintenance of Earth Roads

(Concluded from page 184)

grader. After the initial grading, the road grader, drag or planer should be used after every rain that is sufficient to thoroughly soften the surface. The drag, while an inexpensive piece of equipment, is very effective for the use stated. As a result of this work a continual improvement in the road surface during the season will be effected. It is possible under average conditions by intelligent use of simple road machinery to produce a surface that will rival for smoothness a city boulevard. This condition can be maintained until freezing begins. Certain faults in the road, as a wet spot due to a spring or to excessive shade, bad material, etc., should be studied as they appear and corrected by the proper remedy.

When freezing begins in the late fall the surface will break up under heavy traffic unless the road has practically perfect drainage. No earth road will safely carry any but the lightest traffic during a prolonged rainy season or during alternate freezing and thawing. At this time the road should again receive particular attention. Advantage should be taken of days when the frost is out of the ground to go over the road with the grader,or preferably the drag, and smooth out the ruts and wheel tracks. It will then freeze with a smooth surface that will naturally shed water and melting snow. As a result the road will be agreeable for traffic and will go through the winter with minimum damage.

The main points of earth road maintenance may thus be briefly summarized:

1. Properly drain the road.
2. Properly shape the road.
3. Use the flattest permissible crown.
4. Do not allow false ditches to develop.
5. Do heavy grading only in early spring.
6. Remove all sod and pockets of inferior material from the road surface.
7. Use grader or drag after all hard or prolonged rainfall.
8. Patrol road and correct specific faults.
9. Grade road just prior to winter "freeze-up," also take advantage of warm days to smooth out ruts and wheel tracks.
10. Be vigilant at all times and remember the homely maxim "An ounce of prevention is worth a pound of cure."

Current Highway Legislation—I

(Continued from page 183)

introduced in the House and the Senate. Division engineers will be made "resident deputy commissioners" at $4,500 per year and a new position of first assistant commissioner at $4,800 is also provided. The bill provides that contracts can be made on the unit price basis instead of a lump sum.

Pennsylvania

Senator Buckman on Feb. 17 introduced a bill appropriating $200,000 for continuing the purchase of toll bridges over the Delaware River between New Jersey and Pennsylvania.

The House Appropriations Committee on Feb. 17 reported out two highway bills, one providing for the appropriation of $10,500,00 for construction work during the next two years; the other appropriating $5,000,000 for salaries and expenses of the highway department. For the two years starting June 1, the department will have $37,000,000 to spend on road work. On March 10 these bills passed the Senate and have been signed by the Governor.

On March 10 Governor Sproul signed three measures introduced by Representative McCaig, one of which gives the highway commissioner authority to fix the salaries of deputy commissioner and chief engineer of the department. Another permits the department to use for general construction purposes state aid funds of which advantage has not been taken by the counties. The third permits counties to construct roads without the intervention of boroughs and townships, making it possible for counties to maintain detours on state highway construction jobs.

Texas

The House on March 1 passed a bill fixing a penalty of $1.50 per day for failure to work on the public roads or to pay the stipulated amount for exemption.

A bill has been introduced in the House which permits counties which have unsold road bonds to dispose of them at less than par.

(To be continued)

———ooo———

Bloomfield, N. J., is planning to spend $500,000 for street improvements in the the city during the present year.

Mayflower Relic to be Incorporated in Pacific Highway Peace Memorial

An interesting ceremony recently took place at Jordans,, Buckinghamshire, England, when the American Society of Friends received a piece of the timber from the ship, Mayflower. The relic is to be incorporated in the Peace Portal erected on the Pacific Highway at Blaine, Wash. Members of the party who took part in the ceremony were, Samuel Hill, Honorary Life President, Washington State Good Roads Association, Baron Moncheur, Belgian Ambassador to England, and A. Cotterell, of the English Society of Friends.

South Carolina Cuts Highway Force

Failure of the Legislature to Appropriate Sufficient Funds Necessitates Reduction in Number of Workers in Highway Department

Because the Legislature failed to appropriate sufficient funds, the State Highway Department of South Carolina has been compelled to reduce its force, according to Chief Highway Engineer Moorefield.

The number of divisions will be reduced from four to two and the number of draftsmen and engineers connected with the department will be reduced on April 1. The force of draftsmen will be reduced from 18 to 6. The appropriation made last year for engineering was $80,000, which was cut to $60,000 for this year.

Michigan Short of Funds

State Treasury Will Be $5,00,000 Short by October—Raising Limit of Annual Road Bond Issue Recommended as Relief Measure

Michigan's treasury will be without funds after Oct. 1, according to a report on state finances by Prof. David Friday of the University of Michigan, recently submitted to the governor. The shortage will amount to approximately $5,000,000.

Relative to the State Highway Department, the report says:

"Its funds for meeting its obligations now in progress are exhausted. If it can find a market for the bonds which it is legally entitled to issue the remainder of this fiscal year and next year, it will be able to meet its obligations on contracts now outstanding. The taxes of 1921, together with a small balance left from the sale of bonds, will give the department a credit of $2,015,000 for new construction; but if no new sources of revenue are provided the money will not be available until January, 1922."

In view of this, Prof. Friday recommends that the annual limit of the sale of the road bond issue be increased from $5,000,000 to $10,000,000.

Wyoming to Vote on Road Bond Issue

On May 10 the electorate of the State of Wyoming will vote upon a proposed $1,800,000 road bond issue. If the issue is authorized by the people, the bonds will be issued in denominations of $500 to $10,000 bearing 5% interest and will run for 20 years.

California Will Market Road Bonds

The State of California will offer for sale on April 14, $4,000,000 of road bonds, according to State Treasurer Richardson. This includes $1,000,000 of the second highway issue bearing 4½% and $3,000,000 of the third highway issue which bears 5¼% interest.

New Jersey to Break Ground for Hudson River Tunnel

On April 16 the breaking of ground on preliminary work on the interstate Hudson River vehicular tunnel will be celebrated in Jersey City, N. J. Ground was broken last year on the New York side. Many prominent state and city officials are expected to be present at the celebration.

At the meeting of the tunnel commission on March 8, Chief Engineer Holland reported that satisfactory progress had been made on the construction of the experimental tunnel at the University of Illinois, where the problem of ventilation will be studied. The duct of the tunnel at the university is about 300 ft. long and 3½ ft. high. Another tunnel has been constructed in Pittsburgh by the Bureau of Mines and experimental work on ventilation is being carried on.

Townsend Bill to Come up Again

Determined Effort to Secure Passage of Former Measure to be Made at Extra Session

Senator Townsend has announced his intention of introducing his bill again at the extra session of Congress.

The Townsend Bill proposes a commission to take over all federal aid activities, to administer the federal aid law and to lay out a national system of highways. Its proponents insist that the only way for the Federal Government to get a national system of highways is to pick the routes, construct the roads, and maintain them.

The commission to be created by the Townsend Bill would be composed of five men appointed by the President, who would take over the activities of the U. S. Bureau of Public Roads.

Senator Townsend was instrumental in defeating further federal aid appropriations at the last session of Congress, desiring to have his own bill enacted.

Mayor of Denver Would Enjoin Sale of Colorado Road Bonds

Mayor Bailey of Denver, Colo., has instructed City Attorney Marsh to enter suit against the State Highway Commission to enjoin the commission from issuing $5,000,000 road bonds authorized at the last general election. According to the mayor, the action will be taken because the County of Denver, which includes the city, is paying one-third of the road taxes of the state and will receive no benefits from the bond issue.

U. S. Bureau of Public Roads Makes Report on California Highways

Studies 1,262 mi. of State Highways and Upholds General Policy of Department

Automobile clubs in California last year employed engineers to survey the highway situation in the state. Their reports contained adverse criticisms on the pavements laid, and to meet this situation, an impartial and comprehensive survey has been conducted by the U. S. Bureau of Public Roads. This is declared to be "the most comprehensive study of results obtained through the development of a state highway system that has yet been undertaken," and it includes a study of both the engineering and economic aspects of the state highway system. In all, 1,262 mi. of state highways were classified according to condition into six divisions, A, B, C, D, E, F. It was found that only 12½% was in the last three classes, most of which was built on difficult subgrades of adobe and clay.

Over 600 sample cores were taken from the pavements, which showed an average compressive strength of over 3,000 lb. It was found that the compressive strength decreased with the age of the pavement. (This is an interesting point in that it brings forth the question: Is concrete subject to fatigue under vehicular impact?) The density of the pavements ran 140 to 160 per cubic foot.

Among the general conclusions of the report are the following:

The state highway system has, in general, been well selected and laid out. The mileage prescribed by law has far exceeded the funds, and these discrepancies distorted the policy. The mileage remaining to be built is far in excess of the capacity of the third bond issue and of available federal aid.

The order of selection and construction of roads from year to year has been largely controlled by necessary policy.

A sum equal to the total net motor vehicle fees at the present average rate will probably always be required for the absolute maintenance and improvement of state highways as construction of the 5,560 mi. progresses.

The concrete itself is not generally defective in strength, nor does it show any wear by traffic.

The standard of design and workmanship of structures is high and the costs have been very reasonable.

There is nothing presented by the entire California study that indicates that concrete is not a successful pavement.

The 4-in., 15-ft. concrete pavement was continued beyond the point of success on adverse soils and more time will be needed to develop a type of construction certain of success on such soils.

The report further states that the use of the oil top is not justified and that concrete roads should be 18 ft. wide and 6 in. thick, with reinforcing.

Kentucky Counties May Meet Federal Aid Allotments to State

Recent Court Decision Permits Such Action and so Insures Carrying Out 1921 Program

Kentucky's road program for this year was saved by the recent opinion of Judge Thomas, refusing an injunction to the county attorney of Lawrence County, who sought to restrain the Fiscal Court from appropriating $125,000 to meet federal aid on road work in the county. Lawrence and other counties offered to pay the state's share for the construction of the Mayo Trail, a federal aid project. Besides the Mayo Trail, sections of the Ohio River Road, Midland Trail and Jackson and Dixie Highways were affected by this opinion.

Judge Thomas said the money was appropriated for this particular highway and would be spent on the designated highway and that turning the money over to the state is not delegating a power of the Fiscal Court, because there is no legal bar to the county delegating another to do the work.

———ooo———

The City Council of Toronto, Ontario, has resolved to widen Yonge Street to a width of 86 ft.

Muskogee County, Oklahoma, plans to build 20 mi. of gravel road at an estimated cost of $200,000.

Vanderburg County, Indiana, has prepared a road program involving the expenditure of $750,000. This is the largest road program ever planned by the county.

The Harrison County, West Virginia, County Court has appropriated $110,000 to be used in improving the Clarksburg-Fairmont Road. To this amount will be added $39,000 available from federal aid funds.

Jefferson County, Kentucky, will issue $171,000 road bonds to cover the cost of construction of projects on the River Road, the Georgetown-Edwardsville Road and the Scottsville Road, for which contracts were recently awarded.

EQUIPMENT—TRADE—MATERIALS

New Austin Gasoline Shovel

A new gasoline shovel, known as model 6-T, has been placed upon the market by the Austin Machinery Corporation, and is shown in the accompanying illustration.

The machine is equipped with patented air controlled clutches which enable the operator to manipulate the principal controls with ease, thus eliminating the objectionable hand clutch. The cushion drive clutches of swinging and crowding devices insure the necessary overlapping of operations. All operations may be quickly reversed at any time. The swinging machinery and hoisting drum are locked by means of automatic brakes when the power is shut off.

MODEL 6-T AUSTIN GASOLINE SHOVEL

It is claimed by the makers that this shovel has many advantages and that it can be operated with great ease and very economically.

Warren Brothers Company Sues California Contractors

The Warren Brothers Company, Boston, Mass., has filed a suit against Thompson Brothers, Fresno, Cal., contractors, charging infringement of patents held by the Warren Company. The complaint, it is said, asserts that the defendant is about to undertake a large contract in Fresno County and proposes to use the patent owned by the plaintiff in the preparation of street material, without paying the required royalties.

Some time ago the county engineer of Fresno County drew up specifications for a new surfacing known as "Type A," and according to the county officials, the materials specified are approximately the same as those specified for Warrenite, but the mode of laying and rolling is varied from that required on the paternal pavement.

Buffalo Men Form Material Company

The Empire State Road Builders' Supply Co. has been formed in Buffalo, N. Y., with a capital of $500,000 and will deal in road materials. Directors of the company are, F. W. Knickenberg, Buffalo; E. J. Bailey, Brocton; James Rosney, Buffalo; Walter Rich, Youngstown, Robert J. Summers, Buffalo; William F. Felton, Buffalo; John F. Constantine, Buffalo.

The Bonney Supply Co., Inc., Rochester, N. Y., has moved its offices to 16 State St., in the Exchange Place Building.

PUBLICATION

MODERN ROAD BUILDING AND MAINTENANCE. By Andrew P. Anderson, Highway Engineer, U. S. Bureau of Public Roads. Paper, 6x9 in., 146 pages. Illustrated.

The matter contained in this book is divided into five sections, viz., plannng the road, road materials, road construction, road maintenance and the use of explosives. Being written by a man familiar with the recent investigations of the U. S. Bureau of Public Roads, this work is thoroughly up-to-date and can be read with profit both by the county road commissioner and the state highway engineer. The book is published by the Hercules Powder Co., of Wilmington, Del., from whom copies may be obtained.

———ooo———

Wharton County, Texas, recently sold $653,000 of road bonds to the Hanover National Bank of New York City.

Garfield County, Oklahoma, wll spend nearly $225,000 on bridge work this year. Forty concrete bridges have been built in the county since last July.

Randolph County, Alabama, has placed a tax of $10 per year on all residents of the county, the revenue to be used for road improvement. Persons not paying the tax must work ten days on the roads.

Sequoyah County, Oklahoma, will vote on March 29 on a $202,000 bond issue to be used for the construction of a bridge over the Arkansas River. Muskogee County has already voted a bond issue to be used for this proposed bridge.

MEETINGS

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12—Canadian Good Roads Association.—Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 23-26—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

PERSONAL MENTION

R. C. Terrell has resigned as state highway engineer of Oklahoma.

Norman S. Sprague has resigned as city engineer of Pittsburgh, Pa.

D. T. Black has been appointed city engineer of Galt, Ont., Canada.

C. H. Huston has been elected president of the Lee Highway Association.

T. Ikeda of Japan is now in this country studying road building methods.

Charles F. Healey has been appointed assistant city engineer of Chicago, Ill.

V. B. Fredenhagen has been appointed county engineer of Jewell County, Kansas.

F. R. Polk has resigned his position with the Illinois Divison of Highways to engage in teaching.

B. E. Clark has been appointed state highway engineer of the Oklahoma State Highway Department.

F. G. Twitchell has resigned from the Arizona State Highway Department to enter railroad work.

Frank D. Hain, formerly City Engineer of Altoona, Pa., is now with the Altoona & Logan Valley Trolley Company.

V. S. Peterson, Assistant City Engineer, Chicago, Ill., has been transferred to the comptroller's office as chief efficiency engineer.

Charles H. Abbott has been appointed superintendent of highways of Allegheny County by the Pennsylvania State Highway Department.

Arthur Cook has been appointed superintendent of highways of the Cattaraugus Indian Reservation by the New York State Highway Department.

Harry J. Bero has been appointed superintendent of highways of the Saint Regis Indian Reservation by the New York State Highway Department.

Richard Rosenberg has been appointed superintendent of highways of the Allegheny Indian Reservation by the New York State Highway Department.

Charles W. Erisman has resigned as district engineer of the Pennsylvania State Highway Department to engage in consulting engineering, with offices in Lancaster, Pa.

Polk County, Georgia, recently voted a bond issue of $400,000 for highway improvement.

Scottsbluff County, Nebraska, will vote upon a $125,000 bond issue to be used in building bridges in the county.

Laramie County, Wyoming, will vote at a special election on a proposed $150,000 bond issue to be used for road work.

Wilcox County, Georgia, will hold an election to vote upon a $100,000 bond issue to be used in building the section of the Dixie Highway in the county.

Washington County, Pennsylvania, will spend about $750,000 on road work in 1921, according to E. M. Cheney, County Engineer.

Monmouth County, New Jersey, failed to receive bids on March 9 on $1,079,000 long term road and bridge bonds. Bids were received, however, on $280,000 of bonds bearing 6% interest and maturing in five years.

The City Commission of Atlantic City, N. J., has authorized the issuance of $310,000 of bonds for street improvements. The bonds will be in denominations of $1,000, will bear 6% interest and will mature in three and six years.

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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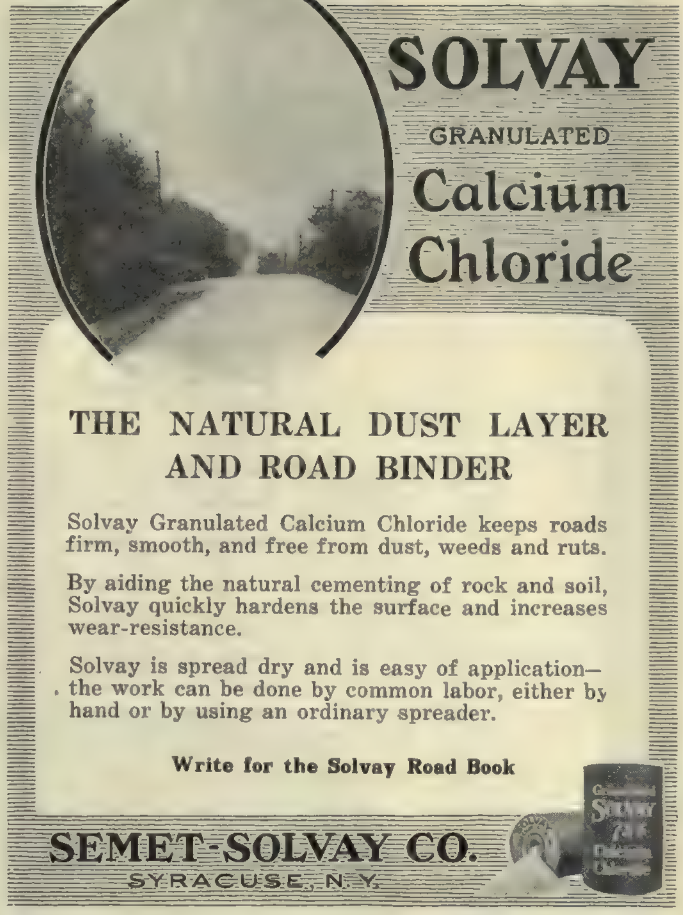

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JAMESTOWN, N. Y., APRIL 6, 1921

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14

Current Highway Legislation—II

Lawmakers in Various States Consider Measures Relating to the Organization of Highway Departments and Financing Road Work

(Continued from March 30)

In addition to the road laws and bills noted in GOOD ROADS of March 30, numerous other measures are under consideration in the various states. Some of the more important are reviewed in the following paragraphs.

Arizona

A bill was recently introduced in the Senate validating the highway bonds of Maricopa County. This county has authorized two bond issues amounting to $8,500,000 and has contracted for the construction of 280 mi. of concrete highway, to be completed in three years.

Arkansas

On March 9 Governor McRae signed a motor vehicle bill which provides fees of 25 ct. per horse power and 25 ct. per 100 lb. gross weight of passenger motor vehicles. Truck fees are as follows: Trucks equipped with pneumatic tires, 1-ton, $15; 2-ton, $25; 2½-ton, $36; 3-ton, $50; 3½-ton, $65; 4-ton, $80; 4½-ton, $100; 5-ton, $125. The fees for trailers and semi-trailers with pneumatic tires are, 1-ton, $10; 2-ton, $15; 3-ton, $35; 4-ton, $40; 5-ton, $50. The fee for motorcycles is $5 and for sidecars, $2.50. The counties will get 70% and the state 30% of the fees. The bill also abolishes the office of attorney for the State Highway Department and transfers his duties to the attorney general.

Colorado

On March 10 the House passed a bill abolishing the State Highway Commission and providing for the appointment of a highway engineer to supervise all road matters.

Connecticut

The Legislative Committee on Roads, Bridges and Rivers has under consideration measures providing for a fine of not less than $2 nor more than $25 for pedestrians who are guilty of willful neglect on the highways. A bill which would make it compulsory to walk on the left side of a road at night is also under consideration.

A bill providing for tolls on the Washington Bridge between Milford and Stratford was defeated in the House.

House Bill No. 403 provides that towns of the state shall keep their bridges in condition to support 8 tons.

Illinois

A bill was introduced in the House and Senate on March 10 which gives the Illinois Department of Public Works and Buildings jurisdiction over a state highway system of 17,000 mi. which includes all state aid roads, all roads constructed under the acts of 1913 and 1917, all federal aid roads and all bond issue roads. The state will maintain this system and, in addition, the measure permits the Division of Highways to purchase and operate gravel pits, sand pits, or other material sources used in the construction of highways.

On March 17 Representative Holiday introduced a bill which provides that counties may submit bids for the construction of roads. The bill further provides that the state may condemn Portland cement plants and use the product in the construction of roads.

Senator Glackin has introduced a bill providing for the raising of interest on local improvement bonds from 5 to 6%.

Representative Moore has introduced a bill providing for the manufacture of road building material by the state nad the creation of a commission of five members to purchase or lease sites suitable for plants.

Indiana

A bill has been introduced in the Indiana Legislature providing for the elimination of county road superintendents and the establishment in each county of the office of county commissioner of highways. These county commissioners must pass examinations and will have charge of maintenance patrol in the counties. The bill plans the elimination of county maintenance levies and the substitution of a state levy, the money reverting to the counties on the basis of improved highway mileage. Motor vehicle fees will be returned to the counties for maintenance of roads. By means of the provisions of this bill it is hoped to have a thorough patrol system throughout the state.

Kansas

The Senate, on Feb. 28, passed a motor vehicle bill which provides fees of $8 on motor vehicles weighing 1 ton, with an additional 50 ct. for each 100 lb. over that weight. An amendment to place the minimum fee at $5 for Fords was lost. A fee of $300 on trucks of more than 5 tons capacity is provided, this provision being made to discourage the use of heavy trucks. An amendment to give a 20% discount to trucks with pneumatic tires was lost.

Louisiana

An ordinance introduced in the Constitutional Convention provides for the abolition of the small road districts, making the parishes the road districts. It also provides that parishes may vote road taxes not to exceed 20 mills. Half of the proceeds of such tax must be used for maintenance work.

An ordinance was introduced on March 14, which provides that motor vehicle fees shall be used in the construction of hard-surfaced state roads. The ordinance also provides that a tax of not more than 2% shall be levied on gasoline.

Mr. Dupont on March 14 introduced an ordinance providing that no road district be allowed to construct a road without providing for its maintenance.

New Jersey

The Assembly on March 9 appointed a committee to consider highway improvements, composed of Assemblymen Hobart, Runyon, Glover and Pierson. All highway bills referring to state highway improvements will be referred to this committee.

Senator Parry has introduced a bill providing for open specifications in road work.

Assemblyman Pierson has introduced a bill repealing the act of 1912 which provides for a tax of one mill to construct the Hudson River Tunnel and the Delaware River Bridge. This tax was to start next year and be a continuance of the state road tax, which expires in 1922. Last year a bond issue was voted for the tunnel and bridge improvements.

New York

The Senate Finance Committee favorably reported on March 16 all the bills making appropriations except the measure appropriating $7,500,000 for maintenance. Bills reported on this day carry appropriations of approximately $9,500,000, in addition to the bill reappropriating the last $10,000,000 of the $50,000,000 bond issue. The failure to report the $7,500,000 maintenance bill is attributed to the opposition by the automobile club of the state to the Lowman Bill, by which it is expected the revenues will be increased by $2,500,000 through increasing the motor vehicle fees.

Oklahoma

A bill has been introduced in the Senate which would require that the state highway commissioner be an engineer.

The House Investigating Committee has recommended the dismissal of State Highway Commissioner Wood.

Pennsylvania

Senator Eyre has introduced a bill which provides that all motor vehicle fees are to be used by the State Highway Department for maintenance.

Senator Buckman has introduced a bill providing for a constitutional amendment authorizing a road bond issue of $50,000,000. State Highway Commissioner Sadler favors this bill, stating that $23,800,000 of the 1918 bond issue of $50,000,000 has been spent and that the entire bond issue will be expended by the time the proposed issue becomes available. If this bill passes, the proposition will be submitted to the voters in 1923. This bill passed the Senate on March 17.

Texas

The House has passed a bill providing that the State Highway Department be placed under the budget system.

A bill has been introduced by Mr. Williams which provides for the construction of a 5,000-mi. highway system. A state highway fund would be created to consist of 50% of all franchise and gross receipt taxes.

Mr. Williams has also introduced a bill in the Senate providing for the abolition of the State Highway Commission and the office of state highway engineer and the appointment of one state highway commissioner.

A bill has been introduced in the Senate, which provides for the sale of all prison farms and the transfer of all convicts thereon to road work.

Vermont

A bill has been introduced in the House, which provides for the creation of a state highway board consisting of the governor and two appointed members.

The state highway commissioner may be one of the members.

West Virginia

A bill has been introduced in the Legislature providing for the creation of a state highway commission with three members at salaries of $7,500 per year. Provision is also made for the expenditure of $20,000,000 of the $50,000,000 authorized in the November election, to be used for the construction of two main truck highways, one north and south and one east and west.

(To be continued)

* * *

The Application of Engineering Geology to Controlling the Quality of Road Building Aggregates*

By H. S. MATTIMORE†

Engineering geology has been utilized to a large extent in the location of some of our large industries, all successful industries having economic reasons for their location. For instance, in the Lehigh Valley section, where the native rock can be utilized in the manufacture of cement, there are many successful cement plants. Engineering geology is also utilized to a large extent by the blast furnaces and steel plants, many of which keep prospectors in the field continually for the location of flux supplies.

It is rather interesting to study the development of highway work with reference to the utilization of materials. One state started construction in 1898, building roads of the water-bound type. The stone used consisted of limestone and trap rock, because both kinds had been developed for other commercial uses and were, therefore, available. About 1900, an effort was made to utilize other rock and one highway was built of gneiss and one of local sandstone. This was considered rather revolutionary, as the rock known as good highway stone was either limestone or trap. Apparently this experiment was successful, because local stone supplies have been developed to such an extent that an analysis of the material used in that state in 1917 shows that 80% of the material was from local sources.

So long as highway work was confined to the vicinities of large cities, or was within easy hauling distance of commercial supplies, very little attempt was made to develop local sources, but as the program expanded work was done in sections where the commercial supplies were expensive. This would seem sufficient to induce an effort to utilize local materials, but economy did not seem to be a sufficient incentive. The real incentive did come during 1918, 1919 and 1920, when it was almost impossible to secure commercial supplies.

Highways are often built in sections in which railroad facilities are not very good and in which materials have to be hauled 8 or 10 mi. from common carriers. Under such conditions it is not economical to depend upon commercial supplies for, even with good shipping facilities, high freight rates and car shortages increase the difficulties and add considerably to the cost. This was strikingly illustrated during the past construction season.

Experienced highway engineers should realize that geology is one of the major allied sciences, a working knowledge of which can be utilized in many phases of highway construction. Our work has an intimate relation to soils and rocks. We must be familiar with the origin of soils in order to determine their characteristics, and the knowledge of their characteristics is essential to the solution of many drainage problems. We should study the nature of soils and rocks and the position of the strata in order to properly design foundations, because, regardless of how well a structure is built, its stability will depend on the foundation. Numerous failures of engineering structures might have been avoided by a proper study of the native soil or rock used as a foundation. This phase of highway construction is being given considerable study. We have arrived at the stage where we think it necessary to make subgrade investigations and several engineering societies now have committees making such studies.

In order to properly control road building aggregates, some knowledge of their source and nature is essential. The aggregates used in highway work represent a large percentage of the total cost. The price of a cubic yard of stone or sand received on a construction job is the sum of the selling cost at the source and the cost of transportation. The latter cost naturally varies to a considerable extent and at present much effort is being made to reduce it. As the distance from commercial supplies increases, this approaches the prohibitive point and where local materials are available, it seems evident that their development is necessary to reduce these costs.

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*Abstract of a paper presented at the Highway Engineering Conference at the University of Pennsylvania, Feb. 7-11, 1921.

†Engineer of Tests, Pennsylvania State Highway Department.

All engineers realize that the use of local materials is economical, the one objection advanced being that there is no surety of their reliability as to quantity and quality. This certainly is a weak objection and can be overcome by proper investigation.

In investigating any proposed aggregate supply, a knowledge of rock minerals is an advantage, for although the final determination of quality is made by testing, an investigator with some geological knowledge can eliminate very poor materials and also proceed with the investigation of well known qualities of rock without waiting for a test. Quality is the paramount factor in any aggregate, so it is essential that this be ascertained before any source is selected for investigation.

The procedure now followed in material surveys is to work from a geologic map, if such is available, and if not, to proceed with a prospecting party to plot roughly the existing rock formations and their relative positions in the geologic scale. The relative positions of rocks and their general location are of inestimable value to a material investigator. It is a waste of time and energy to seek good road building stone in a country where the formations are composed entirely of shales and poor varieties of other rocks.

After a preliminary investigation, which should be sufficient to ascertain the quality of the rock, the most favorable location, from the standpoint of haul or workability, is chosen for detailed investigation. This is for ascertaining the uniformity of the material and the quantity available, for the latter, to a considerable extent, governs the source's value to the contractor. The quantity, of course, should be sufficient to justify the erection of a plant and to permit obtaining the material from that source up to the limit of economical haul. The uniformity of quality and the quantity available depend to a large extent upon the class of rock and upon its formation. These factors must be recognized by the investigator and full advantage taken of them. For example, the availability of a given source will depend on the rock formation and the condition and position of the rock layers. The dip of rock layers is an important factor in determining the quantity economically obtainable from any source. If an investigator will make a thorough study of the rock formation, it will be a guide to him as to the amount of investigation necessary. For instance, where the rock is of heavy structure and of uniform character, like the Helderberg limestone, the same amount of investigation is not necessary as is required of a formation such as the rocks of the Poconos and Catskills, which consist of a mixture of sandstone and shale.

A study of rock formations that have been subjected to pressure changing the position of the layers often will disclose a change in character and the quality of the rock. As an illustration, a good quality of limestone may be contorted into a laminated structure of poor quality and a good quality gneiss may also be changed to a poor quality of mica schist. Numerous examples of the effect of metamorphism could be cited, but the foregoing will illustrate the importance of studying proposed quarry sources before they are estimated.

The study of sand and gravel deposits will differ from that of rocks in that these deposits are made up of decomposed rocks, and therefore, climatic conditions and water action are the main features affecting them. For instance, in the northern states, glacial deposits are the main sources of sand and gravel. The deposits may be in moraines or they may have been shifted from moraines to other locations by water action. Very few clean sand and gravel deposits occur in the glacial moraines themselves, but the materials from such sources are cleaned by water action and deposited in formations known geologically as kames, or they may be transported long distances by rivers or smaller streams and deposited either in parts of the channel or in banks during freshets.

The main deposits in the states represented here are of water origin and although somewhat connected with glacial deposits, they are so remote from them that it is very seldom necessary to trace back to the parent source. Local supplies of sand and gravel are so limited that dredging on a large scale is seldom resorted to . The investment for this is so great that such workings must be left entirely to the commercial supplies. The available sand and gravel supplies of this character are sought either in banks or shallow rivers and creeks. The bank deposits are generally of a stable nature. Those in creeks depend upon freshet and current action and, although extremely valuable in some sections, we must consider them of an unstable character, generally subjected to at least an annual change.

Although the major part of the foregoing discussion pertains to preliminary investigations, geology can be applied to the inspection of stone and sand supplies during their development. It is not good cooperation by the engineering force to delay investigations until the contractor has started the development of a source of supply. In fact, we should prevent rather than encourage any useless expenditure on his part, but cases do occur where the contractor locates the source upon his own initiative, thereby taking all responsibility. In such cases the engineer is called upon to apply his geological knowledge in order to insure obtaining a material of specified quality.

For example, the speaker has in mind several cases where the contractor insisted on obtaining his stone supply from sources which were not considered reliable enough for the state to estimate. There was

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GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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Vol. XXI APRIL 6, 1921 No. 14

FURTHER NOTES ON CURRENT HIGHWAY LEGISLATION

Last week attention was called here to some of the outstanding features of the proposed highway measures noted in that issue. Additional legislation, which is reviewed briefly elsewhere in this number, exhibits many of the tendencies already commented upon.

The popularity of measures providing for the reorganization of state highway departments and the making of radical changes in methods of administering road work is quite as marked in the legislation noted this week as it was in that reviewed in the previous issue. In addition to the cases noted last week, such measures have been subjects of legislative consideration in Colorado, Indiana, Louisiana, Texas and Vermont.

The measures noted this week include several more intended to increase the revenues obtained from motor vehicle fees. In several states, as previously noted, strong efforts are being made to levy prohibitive taxes on excessively heavy trucks.

One measure that would seem likely to meet with the approval of motor vehicle operators is reported from Connecticut. In that state a legislative committee has under consideration a bill providing for fining pedestrians for wilful neglect upon the highways.

What is perhaps the most radical of the proposed laws is one introduced in Illinois that would empower the state to condemn cement plants and use the product in the construction of roads. This is probably one of the manifestations of the resentment against what some consider the unjustifiably high prices of Portland cement. It does not seem likely that such a measure will be enacted nor that it would stand if it were. The establishment of state owned plants for the production of road building materials is a matter of policy upon which there can be an honest difference of opinion. The confiscation of private enterprises is something quite different.

USE OF THE ALLIED DEBT FOR BUILDING ROADS

The indebtedness of the Allies to the United States on Feb. 1 totaled $9,710,525,310, with an additional sum of unpaid interest amounting to $692,399,577. Various suggestions have been made as to how this country may best utilize this great amount of money, when paid. It might well be used for the building of highways. Life and treasure without reserve were given by this country for the winning of the war and the building of thousands upon thousands of miles of improved highways with the Allied Debt would provide a lasting monument to our part in the World War.

This country is now engaged in paying off its war debts, amounting to billions and billions of dollars The war will be reflected in taxes for many years to come. Yet notwithstanding the burden of the war, the United States is now striving to build a system of improved highways extending to all quarters of the country. This requires money, great sums of money—which means additional taxation. Yet the country hesitates at further taxation as seen in the failure of the last Congress to make an additional federal aid appropriation.

At $40,000 per mile, the Allied Debt would pay for the construction of 242,763 mi. of highway. The unpaid interest on the debt would build 17,309 mi. of highway. Thus without further taxation, the United States could build 260,072 mi. of efficient and serviceable highways. It would take 104 years for Congress, appropriating $100,000,000 annually, to make available for highway construction, an amount equivalent to the allied indebtedness.

Since our hope for industrial, agricultural and commercial expansion lies in the development of a complete system of highways capable of meeting the growing transportation requirements and since the work of improving the highways of this country now constitutes the greatest plan of public improvement ever projected in the history of the world, it naturally follows that the work should proceed as rapidly and with as little taxation as possible. The use of the Allied Debt for highway improvement would permit the rapid completion of our highway system with no additional taxation.

Society of Automotive Engineers Establishes Research Department

The Society of Automotive Engineers has announced the establishment of a research department which will collect and correlate information on matters in the automotive field. In addition, the new department will supervise and standardize tests in industrial laboratories.

Michigan Bankers Refuse 5% Road Bonds

Michigan bankers, after a conference with the State Administrative Board on March 9, announced that it would be impossible to take over $5,000,000 of state road bonds bearing 5% interest. The bankers, however, agreed to take the bonds if the Legislature increased the interest rate to 5½%.

Hudson River Vehicular Tunnel to be Completed by 1925

The vehicular tunnel between New York City and Jersey City, N. J., under the Hudson River, will be completed by 1925, according to a report of the New York State Bridge and Tunnel Commission. It is pointed out, however, that to achieve this result it will be necessary to have the money available so that the contracts can be let promptly. This tunnel will be the largest vehicular tunnel in the world.

MacArthur Bill to be Introduced Again

Another Attempt to be Made to Secure the Passage of Federal Aid Bill Defeated at Last Session by Champions of Townsend Bill

Representative MacArthur of Oregon will revise his bill for further federal aid appropriations and will introduce the measure early in the special session of Congress. The new bill will differ from the bill defeated at the last session in that no appropriation will be provided, the amount of federal aid being left to the committee on appropriations.

The chief opponent of the MacArthur Bill is Senator Townsend, Chairman of the Senate Committee on Roads, who is eager to have his own measure, the Townsend Bill, enacted into law. The Townsend Bill provides for a federal highway commission to construct national highways. However, considerable opposition exists to the provisions of the Townsend Bill and it is thought by many that the revised MacArthur Bill will not be filibustered as it was in the last session of Congress.

Enter the Woman Road Contractor

Miss Elizabeth McCoy has been awarded a road contract by the Good Roads Board of Pipestone, Manitoba, Canada.

New Jersey to Buy Last Toll Road

The New Jersey State Highway Commission has voted to buy the Gloucester Turnpike for $70,000. The turnpike is a 3-mi. stretch of road lying between Woodbury and Gloucester and is the last toll road in New Jersey.

Recent action by the Commission also has eliminated all toll bridges in the state except the Ocean City Bridge in Cape May County. Action to take this bridge over will probably be taken shortly.

Indiana Lacks Road Funds

Legislature Adjourns, Leaving Levying of Tax to State Tax Board—This Procedure Held Unconstitutional — Other Revenues

With the adjournment of the Indiana Legislature a serious question has arisen as to money for state highway work during the next two years. The Legislature did not provide any tax levy; neither did it vote any appropriation for road work, the understanding being that the matter of highway funds would be left to State Tax Board. This action, it is pointed out, is unconstitutional, in that legislative powers are delegated to the State Tax Board. During the recent session of the Legislature a report of the State Board of Accounts alleging waste and irregularities in the State Highway Department was presented to the Legislature. This report undoubtedly was the cause of the failure to provide additional funds. However, motor vehicle and inheritance taxes during the next two years will yield the department about $3,000,000.

Bureau of Public Roads to Investigate Arkansas Road Situation

Protests Against Present Taxation Methods to be Answered by Thorough Investigation

Because of the inequality of road tax distribution under the present laws of Arkansas, the citizens of many districts are entering vigorous protests against the present method of highway development in that state. Under the present laws the counties must meet federal aid appropriations, thus throwing upon certain districts heavy road taxes which in most other states are distributed over the state. In view of the protests from many parts of the state, he U. S. Bureau of Public Roads has announced that it will conduct an investigation of the conditions existing in Arkansas.

On March 9 Thomas H. MacDonald, Chief of the Bureau of Public Roads, sent a letter to Governor

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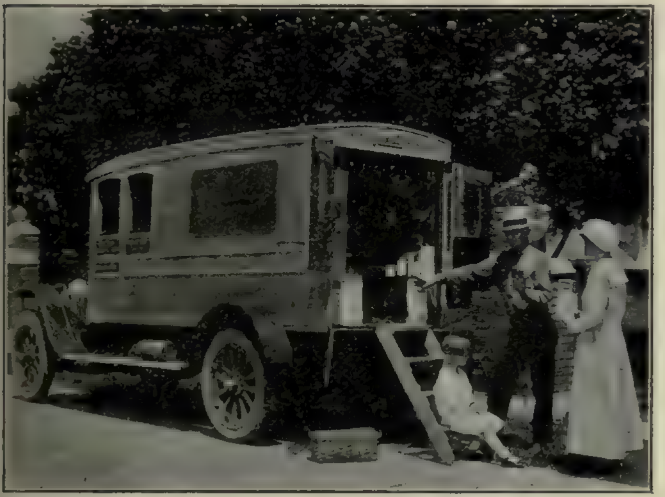
HIGHWAY TRANSPORTATION

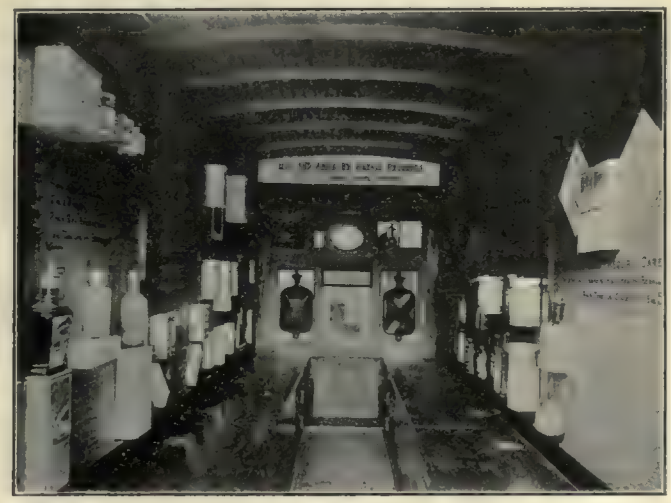
Motor Drug Stores Serve Rural Trade

Fleet of White Trucks, Equipped as Drug Stores, Operated in the Rural Districts of Indiana by a Progressive Drug Company

In the olden days the apothecary set his colored globes in the window of his shop to acquaint the neighborhood with the fact that he was a dispenser of physic. And it was a long, long time before it was realized that the window itself could be used except as a repository for these globes. Less than fifty years ago the cases of the drug store ran right up to the window. But when the germ of better merchandising began to grow, druggists pulled back the cases from the window and built a shelf on which to display their wares. The little panes of glass gave way to one large pane and people began to be attracted by the contents of the window. Thus after an age of waiting for customers to find them, druggists now seek to find and attract customers to their stores.



REXALL HOME SERVICE TRUCK CALLING UPON A PROSPECTIVE RURAL CUSTOMER



INTERIOR VIEW OF WHITE TRUCK, SHOWING FINE MERCHANDISING ARRANGEMENT

With the advent of the motor vehicle, it is now possible to carry the merchandising idea out along ultra-modern lines—the drug store is now enabled to go out and call upon its customers. The first, apparently, to seize upon the idea of a motorized drug store is C. M. Cubbison, head of the home service department of the United Drug Co. Since the motor truck is being used to advantage in other undertakings, reasoned Mr. Cubbison, why cannot its use be applied successfully to the drug store? So Mr. Cubbison prepared to put the idea to the test and promptly proceeded to formulate a definite plan of action.

Nine ¾-ton White trucks were purchased to put the plan in operation. These trucks were fitted up as shown in the accompanying illustrations, and are now traveling in the rural districts of Indiana, a state which, because of its numerous farms comparatively close together and its network of good country roads, was selected for the test. In the beginning two of these trucks were assigned to Fort Wayne and one each to Anderson, Lebanon, Huntington, Wabash, Logansport, South Bend and Frankfort. The territory which each serves is generally the county. First the county is plotted into 20 sections, each embracing approximately 60 homes. Each section constitutes a route to be visited on a specified day every fourth week.

Although the Rexall preparations are pushed by these itinerant drug stores, the fulcrum used to gain the confidence of the farmers is coffee. Since coffee is a commodity universally used, it can more readily be used to win a farmer over as a customer than could Rexall preparations, which at first are probably unfamiliar to the farmer. And having made the farmer a bought customer, the sale of Rexall preparations follows easily. If the customer has not used all the coffee bought on the previous trip, the salesman takes the unused portion and leaves a fresh supply of five pounds. Hence the customer is assured of a supply of good, fresh coffee.

The automobile itself is an object of interest to the farmers and they readily come out and inspect the stock of preparations, sundries, candy, etc. If anything is wanted which is not in the stock of the truck, the order is taken and the goods delivered on the next trip. Further, addrsesed post cards are left with the customer and if she needs anything, she writes it on a card and the salesman brings it on his next trip. Stickers are also supplied to place on the calendar of the customer so as to remind her when the salesman will stop on his next trip. The exact day and hour when the traveling drug store will arrive is known by every customer, consequently the customer knows what she wants and sales are made readily and easily. Each White truck in the Rexall fleet travels approximately 50 mi. in a day's rambling over country roads.

"Of course friendships are won slowly," says J. H. Schaphorst, who handles one of the trucks out of Fort Wayne. "It takes time for the farmer to satisfy himself that we are genuinely eager to serve him, but once his suspicions are allayed, he begins to see that we serve ourselves best by serving him best and hence the benefits of this home service which we extend at some initial expense to ourselves, tend in time to become mutual as sales increase; and they are increasing."

How far this idea of motorized drug stores will be carried out cannot be predicted. With the United States spending billions of dollars in improving highways, with greater refinement and improvement of the motor truck and with the growing demand on the part of consumers for service, it would appear quite probable that at some time in the near future thousands of touring drug stores will be traveling over the good roads in the populous rural districts.

The Army's Highway Transport Problem*

By COL. MASON M. PATRICK†

In the Army we are trained to form an estimate of the situation, to decide what is our mission, and then to proceed to execute it. I conceive that my mission today is to tell you as clearly as I can just how the army is interested in this matter of highways and motor transport, and why the War Department has thought it well to have a representative upon the permanent committee dealing with highways and highway transport education.

In the first place, the roads over which an army must be supplied have been aptly likened to the arteries in the human system. Should the enemy succeed in cutting one or more of these arteries, the same result follows as when a man is thus injured, and to the army may likewise come death or defeat. In fact, it may be safely said that the number, the character and the direction of the roads in any theater where an army is operating have more influence than any other factors in determining its plan of campaign.

Napoleon's axiom that an army travels on its belly is still true, and the soldier cannot fight long upon an empty stomach. He must be fed and his rations must be transported to him wherever he may be. In any active campaign there is a point somewhere behind the lines beyond which it is utterly impossible to transport material by rail. From these railheads all of the many different kinds of material which the army must use can be taken to their destinations in no other way than in wheeled vehicles over such roads as there may be in existence. Take for example our army in France, where we found that it required an average of about 50 lb., made up of many items, per man per day to keep this force going. For the army of 2,000,000 men we had in France when the war ended, this meant transporting daily for longer or shorter distances, something like 100,000,000 lb. or 50,000 tons, no small task as may be readily understood.

Again, the army is interested not alone in the number and in the character of the roads, but likewise in the directions given them when they are located. In France, for example, the highway systems radiated from Paris like the spokes of a wheel. To movements in certain directions this system lent itself admirably, but where it was necessary to transport material somewhat at right angles to the main lines of travel, we met with difficulties. Similarly, in this country, along our strategic frontiers, we must give thought to the directions in which the road systems are laid out. To speak plainly, if we should ever be embroiled with our neighbors on the north—although this is a contingency which we trust will never occur, but to which we must give thought, as more improbable things have happened—it is to our vital interest that the road systems near border states should lend themselves to the movement and to the supply of troops. Similarly, along our southern border, where we face a more turbulent neighbor, it is of prime import that the road systems should enable us to move readily and rapidly, whether for the purpose of crossing the border or repelling a hostile effort originating in the land south of it.

The army is also interested in the matter of motor transport. As I have said before, there is always a point beyond which we must abandon carriage by rail and resort to other methods. It is not too much to say that more than any other one thing the motor vehicle made possible the waging of war on the gigantic scale which we witnessed during the titanic struggle between Germany and the forces opposed to her effort at world dominion. Practically all of the many things needed during such a war, including the men themselves and their weapons, had to be transported in motor cars. It was not at all an uncommon sight to see divisions of 25,000 men moving along the roads in such trucks and not infrequently the odd combination of French trucks driven by Chinamen loaded with American soldiers, as they were carried toward the front to take their places in line or were withdrawn after gruelling days in order that they might obtain a little rest in some more quiet sector.

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*Paper presented at the Mid-Western Conference on Highway and Highway Transport Education at the University of Michigan, Feb. 23, 1921.

†Corps of Engineers, U. S. Army.

While the roads in this theater of war had most of them been in existence for many years, they were practically all water-bound macadam, with here and there some asphaltic surfacing, and they had been kept in repair during the lighter traffic of peace time only by the exercise of eternal vigilance and the prompt restoration of any spot which had been injured. Over these roads the heavier army traffic had to go, and it was imperative that near the front they should be kept in perfect order so that high speed might be maintained. Just as an illustration of the need for roads to be in such excellent condition near the front, it happened one day that a regiment which had been in line for some time was being relieved by another. The incoming colonel asked the officer whose place he was to take to show him over the front of which he had to hold command. The colonel who was going out agreed, and in the new colonel's motor car, driven by a darky driver, they started to make a survey of the part of the line to be transferred from one to the other. When they reached a certain point, the officer who knew conditions well, told the driver the Germans were constantly shelling this road, and that he must be prepared to go at his best speed and be ready to start just after the next shell burst, while he would have about three minutes to get across. The burst came; the car jumped forward and managed to make the safer locality at the other end; but when coming back it had to repeat this same performance, and as the Germans, methodical though they were, had loosed a shell a few seconds earlier than expected, all the occupants of the car had a close call. The driver came to the colonel after they had finished and told him that he thought he would have to ask him to try and find another man to drive the car as driving at such rapid speed was bad for his health. The colonel consoled him by telling him when they traveled that road hereafter they would go very slowly. Needless to say this hardly met the views of the darky driver who proceeded to grow somewhat ashy in appearance and complained that it was just about as bad, if not worse, for his health to drive slowly as it was to drive fast.

One thing particularly noticeable about the main French roads was the thickness of the road metal. This has been developed from year to year and in places is from 2 to nearly 4 ft. thick. It gave an excellent foundation upon which to place the road surface, but when the surface was worn away, it left an exceedingly rough road which, having itself been torn to pieces by the passing trucks, then proceeded to revenge itself by shaking the trucks to pieces. It was borne in upon us then that there must be some cooperation between the builders of motor vehicles and the builders of highways, in order that each might be properly proportioned to the other. At first we were strongly inclined to the more powerful, heavy trucks, each of which would carry a heavier load, and there is no doubt that if the roads are suited to such vehicles they are much the more economical, but this condition was not fulfilled in France, and when we found how rapidly they tore the roads to pieces, we were forced to turn toward lighter vehicles carrying lesser loads; but this, of course, meant more of them, more men to drive them, and more road space required. This is a matter which must be studied with care, and it is hoped that we shall be able to cooperate with highway and automotive engineers in such a manner that their efforts will result in the production of highways and vehicles, both of which will be adapted to the army's needs.

The immense quantity of supplies which had to be transported has already been mentioned and we were, of course, concerned with the amount which could be moved by motor transport. It was figured that with each truck occupying a space of 50 yards, each loaded with two net tons, and the truck train traveling at the rate of 12.5 mi. per hour, about 900 tons of freight would pass a given point in one hour. Making some allowances for accidents, it is estimated that on a good three track, 2-way road, operated all day and all night, about 10,000 tons of motor transport may be taken as a maximum capacity.

There is another matter which we deem of importance, and that is a thorough knowledge on the part of all of our own personnel of the rules of the road and their strict enforcement. When one has seen traffic obstructed—literally miles of trucks and other vehicles held up—due to some minor accident which might have been avoided, and when one realizes the truth of the saying that a world has been won or lost in five minutes, that the fate of an army or of a battle may depend upon the promptness with which its provisions or ammunition arrives, the need for such strict enforcement of traffic rules is borne in upon you in a way and to a degree which will never be forgotten. For example, prior to the attack on the St. Mihiel salient, we had had little practice in formulating and in insisting upon the proper observance of the rules of the road. The roads over which we had to advance had been greatly injured by shell fire, and it was necessary to put them in condition for use. While such work was in progress strict traffic regulations should have been enforced, but this was not the case, and at one point where work was in progress, "A 3-ton truck followed by a string of ambulances dashed down the road into a piece of unfinished work and stuck. Traffic was blocked. Everything else —wagons, carts, kitchens, trucks, tanks, a one-horse sulky, and one man with a baby buggy—poured into the road, filled it solidly from ditch to ditch, and the block was complete." It took many hours of valuable time to restore order, to remove this mass from the road, to continue work upon it and to put it in condition for further use.

If then the men who come to us in the army have had thorough training in such rules of the road, if in this broad land of ours it is possible for a measure of uniformity of such rules to be brought about—and this is certainly desirable—our subsequent training of these men will be made easier, and the interruptions to traffic in time of emergency, which might otherwise disorganize an entire plan of campaign, may possibly be obviated.

It is for these reasons that the War Department does take a keen interest in this particular movement and has appointed a representative on this committee in order that the army may cooperate and may secure a large measure of cooperation in its efforts to fit itself for whatever be the task the coming years may hold.

Now just a word concerning what the army itself is doing to further this movement. You have no doubt heard of the opportunities which are being given to men to learn while they are soldiers to train themselves in order that they may be better citizens when they return to civil life after their brief service with the colors, and it is in just such schools that we are trying to fit them for real, useful work in connection with the enormous problems of road building, of traffic control, and of motor transportation. There are open to all these men numerous courses, for any of which they are encouraged to volunteer, and there have been engaged men as teachers who really know their jobs. It will be understood that we are taking a large number of young men who would never have any college or university training, and many of whom lacked even the advantages of high school training. While we have no ambition, desire or intention to turn them out as college graduates, we do believe that in their three years' term of service we can make them better men, better able to earn their living, and with a sense of respect for law and order which is a wondrous asset when possessed by the citizens of any country, and the lack of which may prove a country's undoing. In these army schools there are now enrolled 40,000 men, and they are taking courses according to their own likings, carefully guided, of course, but still leaving to them a large measure of choice in subjects as varied as music, stenography, dramatic art, blacksmithing, automotive trades, etc. Among these courses we hope to incorporate some which will fit many of these men to take minor positions with state, county or other organizations which are engaged in developing their highway systems. We hope to give these men practical courses which will familiarize them with the materials employed, which will fit them to be foremen, or to operate any of the machines which are employed in highway building. Others will be given instruction in the management of motor transport, particularly with a view to fitting them to become what for want of a better term we may call fleet managers, men who will be capable of conducting numbers of motor trucks running between different points and transporting goods. To my mind this is one of the problems we now have to face and for which we must find a solution. Nearly two years ago, in writing to a young man asking advice as to the course of study he should follow to fit himself for his life work, I suggested this idea. It seemed to me then, and I think it is more apparent now, that in the future vast quantities of material will be carried on our highways in these vehicles, and in order that this may be done most efficiently and most economically, it is essential not only that there should be men who know how to conduct them individually, but others who know how to combine them into large or small fleets and to manage such a combination in a way which will prevent delays, which will hasten the journey, and which will do this without danger to other users of the road.

Pennsylvania Active Against Motor Truck Overloading

The Pennsylvania State Highway Department is carrying on an active campaign against the overloading of motor trucks. In one section of the state, the Pittsburgh district, charges against 150 individuals and corporations of alleged overloading have been placed before the Allegheny County grand jury by officers of the State Highway Department.

U. S. Chamber of Commerce Creates Transportation Department

The creation of a Department of Transportation and Communication has been announced by the U. S. Chamber of Commerce, with J. R. Bibbins, formerly with the Arnold Company, Chicago, as manager. The activites of the department will cover all forms of transportation—land, sea and air. Mr. Bibbins has had a wide experience in dealing with transportation problems in various American cities.

Motor vehicles in the United States last year numbered 9,211,295, an increase of 1;645,849 over the preceding year, according to the U. S. Bureau of Public Roads. Registration and license fees totaled $102,034,106.

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Callahan County, Texas, will vote upon a proposed road bond issue of $1,000,000.

Nassau County, New York, will issue $550,000 of bonds for the construction of the new bridge that is to be erected over the Bayville Creek near Oyster Bay. The present bridge has been condemned.

MEETINGS

Calendar of Coming Meetings

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12.—Canadian Good Roads Association.—Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

South Carolina Road Institute

The Second South Carolina Road Institute was held at the University of South Carolina on March 15 and 16 with about 150 in attendance. On the first day the following papers were given: "The Economics of Highway Construction," by Joseph Hyde Pratt, State Geologist, North Carolina; "Virginia's New Hour," an illustrated lecture by James W. Brooks of the Federal Highway Council; "The South Carolina Highway System," by R. G. Rhett; "Highway Bridges of State-wide Importance," by Wade Hampton; "Bond Issues for County Roads and Securing Right of Way," by W. C. Hamrick; "Road Maintenance," by W. S. Keller, State Highway Engineer of Alabama; "Foundations and Subgrades," by H. G. Shirley, Secretary, Federal Highway Council; "Good Roads and Community Uplift," by C. O. Hearon; "Sand-Clay Roads," by B. R. Cowherd; "Traffic Requirements and Their Relation to Road Design," by J. R. Pennell, County Engineer, Richland County; "Top Soils," by N. C. Hughes, County Engineer, Laurens County; "The Worth of Good Roads," by J. G. Sims.

On March 16 the following papers were presented: "Concrete in Highway Construction," by W. R. Elcock; "Road Location," by F. F. Paton; "Cooperation Between State Highway Department and County Authorities," by W. J. Wise; "Concrete Roads," by J. W. Martin; "Maintenance of Sand-Clay, Top Soil and Gravel Roads," by W. H. Willimon; "Drainage Structures," by Wade Anderson; "The Contractor's Relation to Road Building," by L. T. Slattery; "Relation of the Engineer to Proper Location, Construction and Maintenance of Roads," by Charles H. Moorefield, State Highway Engineer, South Carolina; "Cost Keeping," by L. H. Thomas, Secretary, South Carolina State Highway Commission.

The Fourth Nebraska Road Institute will be held at the University of Nebraska, Lincoln, on April 21 and 22.

The Chautauqua County (New York) Association of Highway Superintendents held its annual meeting at Mayville on March 16. N. W. Dickenson of Hanover was elected president; A. J. Anderson of Ellington, vice president; A. M. Gieger of Sheridan, secretary and treasurer.

Bureau of Public Roads to Investigate Arkansas Road Situation

(Concluded from page 196)

McRae of Arkansas, stating that provision should be made for matching federal aid funds with state funds and provision should be made against the undue assessment of agricultural lands for highway improvement. "This can be secured," said Mr. MacDonald, "by providing a state fund to meet the federal funds so that the principal highways can be built through localities of low valuation without undue tax burdens."

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Madison County, Alabama, will vote upon a proposed bond issue of $300,000 for road construction.

The City of Wilmington, Del., plans to pave a number of streets at a total estimated cost of $450,000.

The City of Texarkana, Tex., will issue a $300,000 bond issue to be used in improving the streets of the city.

Dawes County, Nebraska, will vote upon a proposed $250,000 bond issue to be used for the construction of bridges in the county.

Mobile County, Alabama, will hold an election on April 26 to vote upon a $250,000 bond issue for highway improvement.

PERSONAL MENTION

C. C. McCamy has been appointed city engineer of Dalton, Ga.

John Swan, Director of Public Works, Pittsburgh, Pa., has resigned.

B. L. Taylor has resigned as engineer of Woodbury County, Iowa.

E. P. Ford has been appointed city engineer of East San Diego, Cal.

John A. Baird has resigned as city engineer of Sarnia, Ont., Canada.

D. E. Gilmer has resigned as county engineer of Reno County, Kansas.

J. C. McElherne has been appointed engineer for Rice County, Minnesota.

John F. O'Toole, Superintendent of Highways, Pittsburgh, Pa., has resigned.

E. W. Jenkins has been appointed superintendent of streets of Worcester, Mass.

C. J. Swift was recently appointed highway engineer of Blue Earth County, Minnesota.

C. F. Lightfoot has been elected president of the Mississippi River Scenic Highway Association.

Dwight B. Coleman has resigned as county superintendent of highways of Cortland County, New York.

William J. Dwyer has been appointed county superintendent of highways of Cortland County, New York.

T. A. Adams has been elected chairman of the New Jersey Interstate Bridge and Tunnel Commission.

E. M. Barradale has been appointed secretary of the New Jersey Interstate Bridge and Tunnel Commission.

Perry Filkin, Division Engineer at Hornell of the New York State Highway Department, has been tranferred to Buffalo.

H. M. Thurston has resigned as county highway engineer of Winona County, Minnesota, to go into the contracting business.

Theron M. Ripley has been appointed division engineer, with headquarters at Hornell, by the New York State Highway Department.

John Kaines has been appointed superintendent of highways of the Onondaga Indian Reservation by the New York State Highway Department.

Frank Owen has been appointed superintendent of highways of the Tonawanda Indian Reservation by the New York State Highway Department.

The Application of Engineering Geology to Controlling the Quality of Road Building Aggregates

(Concluded from page 191)

no doubt that these sources contained some material of excellent quality, but there was also some poor rock showing in the outcrops and the sources did not seem to be economical. Under such conditions, especially considering the difficulties of securing commercial stone, the contractor was allowed to try to obtain suitable material from the local sources. The engineering force assisted in selection so far as possible and it always reserved the right to inspect at the crusher. This reservation should always be made for the protection of the state.

Although there is no legal responsibility connected with sources investigated, and to some extent recommended by the state, there is a moral responsibility which the investigator must realize.

The speaker had several objects in mind in this discussion:

First, an endeavor to convince highway engineers that necessity and economy demand the utilization of local material in sections where such material occurs in sufficient quantity and of a suitable quality.

Second, an encouragement to apply the science of geology to meet some of our highway problems.

The highway problems of the present day are approaching the stage where they require study and investigation, and the earnest highway engineer must solve them. Engineering publications are emphasizing the fact that appropriations for highways are larger than those for any other kind of public work. The construction of these highways is entrusted to highway engineers. The people must have had confidence in us if they approved the appropriation of such large sums. Now we must justify this confidence by constructing durable types economically.

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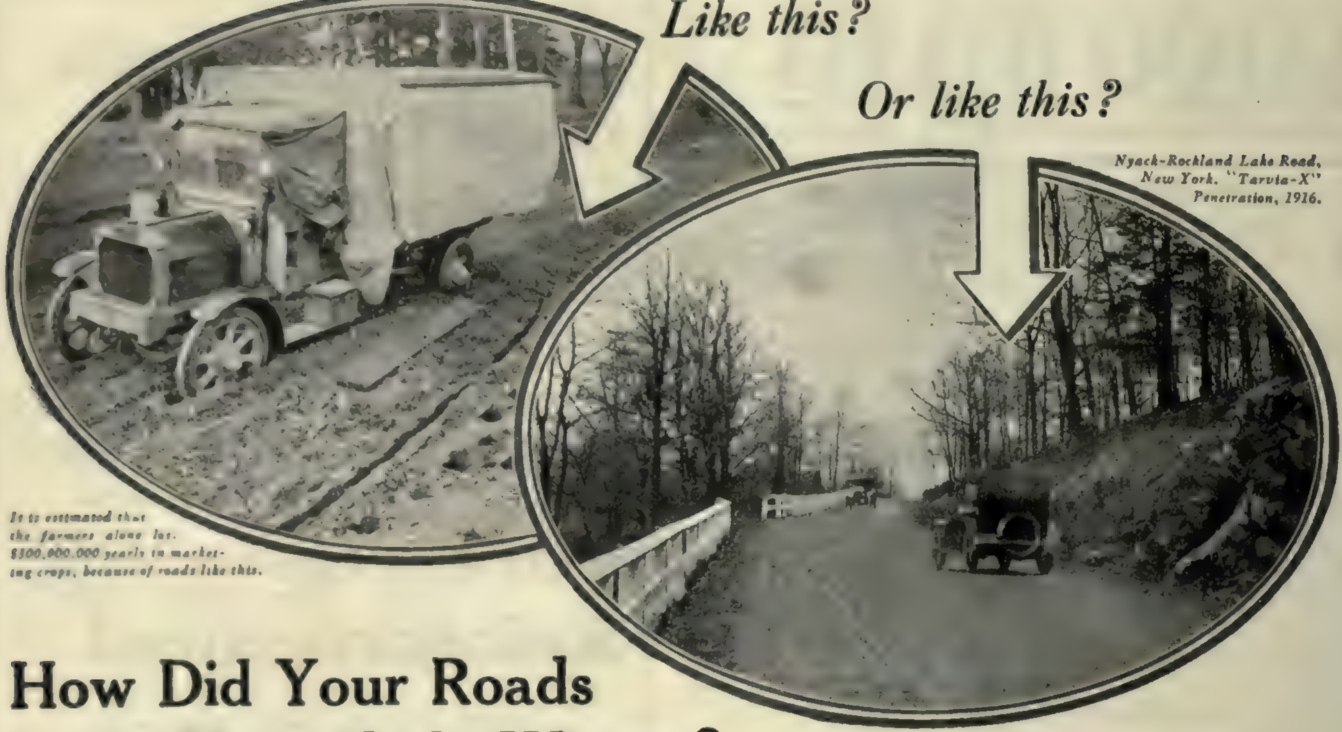

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Testing and Laboratory Control of Large Highway Contracts[*]

"Secret" Formulas and "Mysterious" Processes Have Been Replaced by Scientific Methods—Effect of Quality of Materials Upon the Finished Pavement—True Economy Lies in Using Proper Materials and Methods — Importance of Records — Inspection — Cooperation

By R. B. GAGE[†]

There was a definite reason why the steels prepared from the Damascus and Norway ores possessed certain properties that made them famous. It was a secret that remained unknown for nearly two thousand years, but at last the chemical engineer found it. We know now that as good, and even better, steels can be prepared from almost any first class ore.

What has been accomplished with iron and steel can be accomplished with other products, though probably not to so great an extent. The mystery surrounding products or materials supposed to have peculiar properties, because prepared by certain individuals or in a mysterious manner, is rapidly being replaced by scientific methods which have demonstrated that a duplication of efforts and materials should give a duplication of the product. However, in certain industries these mysteries still persist. At one time they were quite familar to the paving industry, particularly in the construction of asphaltic pavements. Contractors had particular methods and formulas of their own which no one else knew and, consequently, could not use. Yet pavements were constructed without these mysterious formulas and were just as good as—and often better than—pavements constructed by the formulas.

The properties of the materials used in road and pavement construction have been fairly well established and standardized. In most cases there is nothing whatever mysterious about them, and a duplication of materials and methods should duplicate the product. Unfortunately, however, we are compelled to admit that our different items of construction are not always duplicated.

The variations in the quality of products can usually be traced to methods of construction, equipment, or materials; yet poor results from the use of inferior materials are gradually being reduced as the character and properties of different materials become better known and standardized. It is natural to assume that in protecting a product against injury from the use of unsatisfactory materials, requirements are often drawn more rigidly than would be necessary were the properties of the materials standardized for the particuar purpose, thus often increasing the cost. It is often very difficult, even when the properties of the materials have been definitely established, to know just where to draw the line. For instance, a certain material may give a product of only 90% quality, yet its cost may be so low, compared with a similar material that will give 100% quality, that its use is justified. The deficiency can often be offset by a change in the method of manipulation or in the quantity or quality of other ingredients used.

In analyzing causes of pavement failure it is generally found that, insofar as the materials are concerned, the quality of one or two materials will affect the pavement more adversely than all others combined. Consequently, it is false economy to jeopardize the life of a pavement by the use of an inferior material because it can be secured for a little less. The saving effected by such procedure is usually only nominal and it may shorten the life of the pavement 50%. If we were able to see within a year or two the injury done, no doubt the use of such materials generally would be abandoned; but as a rule the injury is not easily recognized for several years, after the lapse of which the cost and character of the materials used have been forgotten.

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[*] Abstract of a paper presented at the 1921 annual meeting of the New Jersey State Association of County Engineers, Engineers' Club, Trenton, N. J.

[†] Chemist, New Jersey State Highway Department.

Again, it often happens that using inferior materials in order to save a few cents per ton may neutralize the properties of some of the more costly ingredients to an extent equal to several times the apparent saving. This is particularly true of sand in concrete and bituminous pavements, yet specifications frequently permit the use of sand having 75% of standard strength.

It is not the intention to discuss here the necessary tests, but it should be noted that it is certainly very risky to judge the character of a material by observation or previous use, for the appearance of a material is often very deceptive and a given deposit is prone to differ in character in different parts. Consequently, to have any assurance that materials are of uniform standard quality, constant supervision must be maintained of the output.

New Jersey has such an abundance of sand that can be secured at reasonable cost that it is false economy to use an inferior grade of this material. The data we have to date show that the strength of concrete is almost directly proportional to the strength of the mortar and that the strength of the mortar in turn depends directly upon the character of the sand and the quantity of standard Portland cement used. Therefore, if a 75% sand is used we are losing 25% of the strength of the concrete. In other words, a concrete base, 6 in. thick prepared from materials of standard strength, will be just as strong as an 8-in. base built with a 75% sand. The cost of the former will be much less than that of the latter, so that in the end, instead of making a saving we really suffer a loss.

The value of concrete in a base depends directly upon its strength, density and porosity. If it does not have sufficient strength to absorb the inequalities in strength in the subbase, it may fail when subjected to a heavy load. A failure of this kind occurred a year ago on a highway near Trenton, where travel broke through the surface and the concrete base, neither of which was over two years old. The subbase was not properly drained, and so did not possess sufficient stability to compensate for the lack of strength in the base.

The density and porosity of concrete are not always directly dependent upon the character of the materials used, but sometimes upon the quantity of these materials. In general, the density and strength decrease as the porosity increases. Consequently, a strong concrete is denser and more solid than a weaker one. However, a porous concrete base with the desired strength certainly is not so efficient as a base of a similar strength that is dense. In the former case the foundation acts as a sponge, absorbing and retaining water that will shorten the pavement's life in direct ratio to the length of time it is saturated. It is not to be assumed that a pavement on that type of foundation will fail in five years if properly constructed, yet it is certainly safe to assume that it will be extensively repaired or replaced within ten years. In some respects this type of base for a bituminous pavement is of little more value than a macadam base.

It is certainly very risky to reduce the strength of a concrete pavement or a concrete base on the assumption that the subbase possesses sufficient strength to compensate for that lacking in the concrete. Unless we know the strength of the subbase it is certainly wiser to make the concrete of sufficient strength to compensate for any lack of strength in the subbase.

If we are to profit from past mistakes, a definite record should be kept of the materials used and the manner in which they were used. Records are often very obscure, and in many cases it is doubtful if any data whatever could be secured if the engineer, inspector and contractor on the job had died or moved out of the state since building the pavement. We know that on a certain date a contract was let, calling for the construction of a certain type of pavement, and that definite payments were made. Up to that point the records are fairly complete, but beyond it there are practically no data. Records should be so kept that anyone could turn to the files in years to come and immediately see just what materials were used, where they were secured, how they were tested and how they were used. The records should also include the tests on the finished product and a description of the equipment used. Without such records it is safe to assume that past mistakes will constantly be repeated in the future, for unless our present salary scale is materially changed it is very safe to assume that there will be as many changes in the personnel of the Department in the future as there have been in the past. Old employees may not repeat mistakes to which their attention has been called, but new employees can be expected to make most of these mistakes. It is impossible to so instruct a new inspector that he will be as well qualified as another man of equal ability and training, who has also had the practical experience in the field—really the only factor of use in determining an inspector's competence.

If, in preparing specifications for a given job, it were possible to ascertain just what materials would be used and where they would be secured, it would be very easy to specify those materials in such a way as to give the highest grade of product. Unfortunately, in competitive bidding, that would often increase the cost beyond the advantages secured. The materials and the product made from them should be so defined by the specifications that each bidder will know just what he can or cannot use and all such phrases as "suitable for the purpose intended," "of

(Concluded on page 212)

The Educational Activities of the Permanent Committee*

Importance of Transportation and of Highways as Links in Transport System—Formation of the Highway and Highway Transport Education Committee—Its Personnel, Aims and Objects — Problems to be Solved

By C. J. TILDEN†

Two years ago a certain man had a vision. It was not the kind of vision of which we read in stories of the middle ages when men saw hosts of bright angels busying themselves with the affairs of men and coming down to do with superhuman skill and ease tasks that were long and difficult. The modern visionary did not include heavenly hosts in his mental picture, but against a background of the nation's needs in transportation, with railways overloaded by stress of war and reconstruction, with waterways undeveloped and miles of highways going to pieces under vehicle loads hitherto unknown, he saw something of the enormous development in highway construction which must take place in the near future. The picture centered about the highway as the most vital and far-reaching link in the nation's pulsating life of communication and economic interchange. But out of the picture there came with increasing distinctness the need for men — men trained in the science and art of highway construction and maintenance, men trained to research and investigation of construction problems yet unsolved, and above all men trained in the basic principles of business and engineering which underlie the efficient use and operation of highways and highway transport systems.

The picture was clear and distinct. Contemplation only increased and multiplied the myriad details. But our visionary did not call upon a bright angel with flowing robes and shining wings—he wrote a letter to the Commissioner of Education. He wanted to translate that vision into action—just plain human action and plenty of it—and see that the country got busy as soon as possible training those men.

Other men saw the same need and added their voices to the call for action. In January, a year ago, Commissioner Claxton called together six men representing the Bureau of Public Roads, the War Department and his own Bureau of Education to study some of the general problems of highway education and research. This was followed in about two weeks by a conference of nine men representing motor vehicle and other industries, and in April, 1920, an important conference was held at the University of Michigan under the auspices of the National Highway Traffic Association of which Professor Arthur H. Blanchard was president. Nineteen delegates attended, representing the Federal Bureau of Education, engineering schools, automotive industries and state. highway commissions. The following resolution, with fitting preamble, was passed by this conference:

> Resolved, That we, the representatives of education, industry and Government, assembled in conference at Ann Arbor to discuss the problems before us, do call upon the Hon. P. P. Claxton, Commissioner of Education of the United States, to bring this subject to the attention of the people of the United States through a conference to be held in Washington and consisting of the leaders in thought and in action on this subject.

The Commissioner of Education called this conference for May 14 and 15, 1920. Seventy-one delegates, from all parts of the country, were in attendance, representing schools of engineering, state and county highway officials, the automotive and tire industries and their associations, and various departments of the Federal Government. A full report of this conference, and of the principal events leading up to it, which have been but briefly summarized above, has been printed as Bulletin No. 42, 1920, of the Bureau of Education of the Department of the Interior. A day and a half was spent in meetings, conferences and group committee sessions, at the end of which time the conference passed unanimously a resolution which contained the following statements:

> That there is no one domestic activity of more vital import to the people of the United States than an efficient and economical administration of our highway program;
>
> That there is a pressing demand for trained men, not alone to guide this program, but also to undertake the problems of production and economic use of vehicles over the highway;
>
> That this need can only be met by increased educational facilities for turning out these men;
>
> That the entire subject is one which should be closely coordinated and a permanent committee made up as hereinafter designated should be appointed by the Commissioner of Education to consider this problem in its several aspects and to bring about a fuller understanding of it on the part of the people of the country.
>
> That the component parts of this committee should represent the Bureau of Education, the Bureau of Public Roads, the War Department, the state highway departments, the automotive industries, the tire and rubber industries, higher educational institutions, as the groups best equipped to furnish the technical information needed and to work out these great public questions.

It was thus that the Highway and Highway Transport Education Committee, more generally known as the "Permanent Committee," came into being. The make-up of the committee is printed on your program. The Commissioner of Education, Dr. P. P. Claxton is the chairman, representng also the Bureau of Education of the Department of the Interior. Two other important Government departments are represented in Thomas H. MacDonald, Chief of the Bureau of Public Roads of the Department of Agriculture, and Col. Mason M. Patrick, Corps of Engineers, representing the War Department. Industry has its representation in Roy D. Chapin, Vice President of the National Automobile Chamber of Commerce, and H. S. Firestone, Vice President of the Rubber Association of America. W. S. Keller, President of the American Association of State Highway Officials, brings to the committee representation of that important body of public officers, while Dean F. L. Bishop, Secretary of the Society for the Promotion of Engineering Education, represents through that society the engineering schools of the country.

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*Paper presented at the Mid-Western Conference on Highway and Highway Transport Education, University of Michigan, Feb. 23, 1921.

†Director, Highway and Highway Transport Education Committee, U. S. Bureau of Education.

The primary object of the committee has been suggested in the set of resolutions just read. To summarize this in a single sentence it may be stated as the stimulation and encouragement of any kind of educational effort which has to do with the construction, maintenance and efficient operation of the nation's highways. Recognizing the need of a wider public interest in such matters, an important part of the committee's work is that of assisting at conferences, such as the present one here at Michigan, at which highway problems are discussed. It is difficult to appreciate the immensity of our present highway program. According to figures recently compiled in the Bureau of Public Roads, there is available for expenditure in 1921 over $600,000,000, an amount some 50% in excess of the total cost of the Panama Canal. This does not by any means include all the money in sight for highway building, but takes into account only those portions of state and county bond issues and federal aid appropriations which are available during the current calendar year. This expenditure, amounting as it does to nearly $2,000,000 a working day, will call, of course, for a large number of trained engineers.

In most of the higher institutions and technical schools instruction in highway engineerng plays a relatively unimportant part. It would be well if the faculties of engineering schools should recognize more generally than they do throughout the country their responsibility with respect to this rapidly increasing activity. There is not only need of more men to direct and superintend the building of highways, but there are many problems connected with highway construction and maintenance which are not yet solved. These are essentially problems in engineering research of a high order. The National Research Council has recently organized a highway division to coordinate and disseminate the results of research work, but the actual research must be carried on by a great many agencies. Chief among these is, of course, the research department of the Bureau of Public Roads, but to this should be added vigorous effort on the part of state and endowed universities.

Another great opportunity awaits universities and technical schools in training men in the basic business and engineering principles which underlie the use of highways. This has been well named "Highway Transport" and is a rapidly growing business activity. It is surprising, however, how little instruction is offered by university departments of economics in the great problems of transportation. A careful scrutiny of the catalogs of a number of our large colleges and universities fails to reveal courses in the highway phases of economics, and a surprising dearth of such instruction even in the more general problems of transportation. In talking recently with the professor of economics of one of our best known universities, I asked why this was. He made the interesting statement that so little was known about highway economics that it would be quite impossible to construct or organize an undergraduate course, and furthermore that it would probably be five or six years before a sufficient body of facts could be accumulated and digested to warrant such an attempt.

It is interesting to note how several of our well known institutions have at least made a beginning in this direction. First to be mentoned among these is the University of Michigan which is offering stimulating courses in this field in connection with the Department of Highway Engineering. The University of Syracuse has recently started a school of transportation under Professor Raper, who reports that there is very gratifying interest in the courses in motor transportation. The work of Dean Bishop at the University of Pittsburgh should also be especially mentioned, as well as the efforts along this line that have been made at the University of Kansas and the University of Wisconsin.

The highway laws of the different states form a body of legislation which has grown up with little guidance or foresight. Dean A. N. Johnson, of the University of Maryland, published about three years ago a topical discussion of the highway laws of the various states of the Union, pointing out their similarities and divergencies, mostly the latter. There is a great opportunity for further study along this line. Students of the state universities might well study the highway legislation of their respective states. In connection with the problems of economics, the study and consideration of highway laws is of great importance. A large amount of restrictive legislation is now under advisement or has already been enacted, which would have been more rational if preceded by careful economic analysis Where a highway department, for example, sees its

(Concluded on page 213)

Economics of Highway Construction*

Certain Fundamental Principles Must be Applied in Construction of All Roads, Regardless of Cost—Economic Factors in Highway Work — Discussion of Principles of Permanency of Road Building

By DR. JOSEPH HYDE PRATT†

Regardless of the cost of a road, there are certain fundamental principles that must be applied in its construction. Various states have passed, or are considering, large bond issues for roads, and there has been made available in the United States during the past year, $1,000,000,000 or more for road construction. With this large expenditure the economics of highway construction are beginning to be more and more considered; the people are demanding a wise expenditure of the funds.

There is probably no branch of engineering in which so little thought and time have been given to obtaining the engineering data and scientific information necessary to a thorough understanding of the basic principles governing constructon as in highway engineering. I believe that many engineers have realized this need and the greater need of competent engineering, for many failures have been due to the supervision of work by incompetent men. Thus, the first economic essential in highway construction is the drect supervision of every phase of the work by skilled and competent engineers. I say skilled and competent because a skilled mechanical engineer is not a competent highway engineer.

Highway authorities are often confronted by the question of whether the economic advantage lies in building a large mileage of graded roads with low cost surfaces or a lesser mileage of harder surfaced roads. These questions will at once arise: Is the road to become an interstate, intercounty or only an intertownship road? For what purpose is it to be used? What loads are to pass over the road? The solution of the problem depends largely upon the answers.

Are present highways economic failures? Judging by their deterioration and breaking down under traffic, many of them might be considered failures. But if we take into account the purposes for which they were constructed and the manner in which they are used, real and acceptable reasons for many of the failures are recognized. Some roads have gone to pieces because they were not rightly constructed and many others because they have been subjected to a use for which they were not intended. But this does not change the fact that we are not giving the same consideration to the fundamental principles of highway construction that we are to the fundamental principles of other branches of engineering.

Nearly all modern road builders have violated one principle of construction by failing to recognize that any part of the road might be considered permanent. The question of permanency is perhaps indefinite, but there are certain phases of highway construction, such as location and the preparation of the subgrade and foundation, that can be made permanent for generations to come—as permanent as the old Roman locations and foundations.

This question of permanency is an economic one and is intimately associated with several of the principles of road construction, such as: 1, Location and right of way; 2, subgrade or road foundation; 3, drainage; 4, load the road is to sustain; 5, surfacing material—(a) foundation course and (b) wearing course; 6, maintenance.

1. Location and Right of Way: In locating a highway, outside of determining what places it shall connect, all personal feeling and sentiment must be left out. Roads must be located purely for engineering reasons, or it will be necessary to relocate them—as it is now—when more expensive surfacings are to be put down. There is no reason for having to relocate a road that is or is to become part of a national or state highway whenever it becomes necessary to resurface it and make it suitable for heavier traffic. It is not necessary to make all highways in a county or state capable of carrying equal loads, but the main through highways in each state should be built to sustain a uniform weight.

In locating roads—particularly interstate and intercounty roads to be used very extensively for transporting freight—carrying them around cities and towns instead of through them is an economic measure that should be very carefully considered.

Rights of way should be determined and procured before any construction work begins and sufficient width should be obtained to insure proper protection of the road and to allow, where necessary, for sidewalks and tree planting. Many mistakes have been made by not securing sufficient right of way to permit necessary widening at a later date, sometimes entailing thereby a very great cost.

2. Subgrade or the Road's Foundation: In previous years but little consideration has been given to the question of subgrade and often a very costly surface has been laid upon a subgrade incapable of sustaining the surfacing and the load, with the result that many highway surfaces have been broken up unnecessarily. There is perhaps no phase of highway construction that needs more careful supervis-

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*Abstract of a paper presented before the Road Institute at the University of South Carolina, March 15, 1921.

†Director, North Carolina Geological and Economic Survey.

ion than does the design and construction of subgrades. If the subgrade is not properly prepared when the road is constructed it is impossible to repair the damage without completely destroying the surface. No matter what surfacing material is to be used, the subgrade on a state road should be so prepared that, except in rare instances, it will be unnecessary to change it when greater traffic demands a heavier surface.

3. Drainage: While all engineers have given and are giving more or less thought to the question of drainage, they have not always given sufficient consideration to it in connection with the subgrade. Drainage begins with the location of the road, continues through the building of the subgrade and to taking care of the water on the surface. Too much emphasis cannot be laid on giving particular attention to this phase of construction.

4. Load the Road is to Sustain: Before the engineer can decide what surfacing material to use he must know what load the road surface will have to carry, and this, of course, will depend upon whether the road is a national, state, county or township highway.

In the matter of the load to be carried, why have we considered a road surface different from a bridge, a railroad, a warehouse floor, or the floors and roofs of buildings? These are constructed with factors of safety, but we limit the load to that for which they were built. The permissible wheel loads for various classes of roads have not been decided upon by many of the states; are not uniform in those states that have decided; and have not been regulated in any state, so far as I know.

With national highways, constructed and maintained by the Federal Government, a uniform load would be authorized for all national highways in all the states. Similarly, state roads, built and maintained by a state, would be regulated as to loads, and this would be uniform on all state roads in that state. This question of permissible loads is being given serious consideration by state hghway officals, and it is not improbable that limiting wheel loads for various classes of highways will be worked out in the near future and an attempt made to make this uniform throughout the states. With legislative acts regulaitng the wheel loads of motor trucks, character of tires, etc., we should also regulate the loads of wagons and the relation of the load to the width of tire.

Is a healthy economic condition created if a state allows 7½-ton trucks (four wheelers) to use its public roads when it is limiting the loads on these roads to 20,000 lb. or less? Whenever possible, users of freight trucks will load them to their stated capacity and often to 50% more in order to increase their earning capacity. If the excessively heavy and frequently overloaded trucks cannot be kept off the roads by lelgislative acts, they can be taxed sufficiently to almost, if not quite, prevent their economical use; or we can limit the load per wheel and enforce the law. Instead of being taxed according to their horse power, they should be taxed according to their tonnage, based on the extent to which they will damage the roads.

There must be a limit of wheel load for motor trucks so that a highway of a given type can be constructed for a known weight that its surface will have to sustain. This is essential, and should be uniform throughout the country.

5. Surfacing Material: (a) Foundation Course: By foundation course is meant that portion of the so-called road surface that rests upon the subgrade and is not subjected to any direct wear from traffic. I am thoroughly convinced that we have often made the mistake of making the foundation and the wearing surface a unit instead of two units. I believe that in the long run better results will be obtained if the foundation or lower course of the road surface is considered as one unit and the wearing or upper surface is considered as another unit. We have been building expensive concrete roads, costing from $20,000 to $85,000 per mile, that have consisted of simply a concrete slab of varying thickness resting on a subgrade of unknown character. Even with a perfect subgrade, I would prefer a concrete slab with a bituminous concrete top to an all concrete slab. I believe that in many sections on the South, where large quantities of stone are available and accessible, extremely good roads can be obtained from a foundation of heavy rock, similar to a Telford base, and a thinner course of bituminous concrete as the wearing surface.

(b) Wearing Course: The surfacing material will depend upon the character of traffic, permissible load, and the class of road—state, county or township. Township roads, and many county highways, can be surfaced with sand-clay or gravel, and give very satisfactory service. Some county highways will need a higher type of material. On the higher types of roads there should be two courses—the foundation course already referred to and the wearing surface. The cost of maintaining the wearing surface as a smooth surface under traffic will have a determining influence on the selection of the material to be used in its construction. Here again the traffic will have to be considered and the need of a traffic census emphasized.

6 Maintenance: With the completion of construction, maintenance begins; and upon the efficiency of any state's maintenance system depends in a very large measure the success or failure of that state's road program. Unless the principles previously mentioned have been carefully observed, the maintenance of the roads may become a very severe burden to the community. If, on the other hand,

(Concluded on page 213)

Current Highway Legislation—III

Lawmakers in Various States Consider Measures Relating to the Organization of Highway Departments and Financing Road Work

(Continued from April 6)

The legislators of the several states are still busy framing legislation dealing with policies of hghway development. Many of the bills introduced are tinged with politics, especially the numerous bills which seek to change the organization of the state highway departments. The following report enumerates new measures introduced and summarizes the action taken on bills previously reported in Good Roads.

California

A bill has been introduced by Senator Shearer which seeks to levy a license of 7% on the gross receipts of motor bus lines. A bill introduced in the House provides a 10% tax on gross receipts of motor bus lines.

Senator Thomas introduced a bill on March 17 providing for the taking over the Placerville-Auburn Road as a state highway.

A bill has been introduced by Senator Johnson authorizing the State Highway Commission to construct a road from San Benito to the Santa Cruz main lateral road.

Delaware

House Bill No. 212 provides that the State Highway Department may take over as state highways sections of any main route lying in towns, but cannot change the width of a highway in a town without the consent of the town. All agreements, it is provided, which were entered upon by towns and the State Highway Department for the construction and maintenance of highways in towns, are hereby annulled.

Idaho

House Bill No. 314 has passed the House. This measure apportions the receipts anticipated from the $2,000,000 highway bond issue. As passed by the House the apportionment was to be made to the counties on a schedule based on assessed valuations. In conference a Senate amendment which would make the apportionment recognize highway districts within counties, was drafted. This amendment was adopted by the House.

Iowa

In a report submitted to the Senate on March 8, the State Highway Commission was entirely exonerated of charges of inefficiency pressed by J. F. Gallup, an attorney of Jefferson.

The House Committee on Roads and Highways has introduced a bill to create a primary road contingent fund. By the provisions of this measure, the state treasurer is directed to set aside $150,000 from the primary road fund, to become the primary road contingent fund. When claims are made for freight, labor, etc., which must be paid promptly and which are payable from the primary road fund or the maintenance fund, the commission may draw warrants upon the contingent fund.

Maine

A bill has been introduced in the House providing for the issuance of $3,000,000 road and bridge bonds, bearing 5% interest and maturing within 41 years.

The House Committee on Ways and Bridges has reported favorably a bill providing for the construction of a bridge over the tidewaters between Orr's Island and Bailey Island in the Town of Harpswell.

Michigan

A bill has been introduced in the Senate which provides for the planting of trees along the highways of the state. The State Highway Commission is given power under this measure to plant trees and shrubs along state and state aid highways.

Minnesota

On March 15 the Senate Committee on Highways by a vote of 12 to 5 approved of the plan of a single state highway commissioner. This point has been holding up action by the Senate on the highway bill passed by the House.

The Senate Committee on Highways has also recommended for passage a bill authorizing the railroad commission to require the elimination of grade crossings and charge the cost to the railroads, and a bill providing for the payment of the expenses of county commissioners to a road convention to be held this year.

Missouri

Missouri still continues to grope blindly in a tangle of ill-wrought road legislation. A bill was passed in the Senate providing for the submission of a constitutional amendment to the voters to use $10,000,000 of the proposed $60,000,000 bond issue for maintenance. The bill was defeated in the House by a vote of 80 to 9.

New Jersey

On March 28 the Senate passed the Assembly bill that will put under control of the State Board of Public Utility Commissioners all motor buses not in operation March 15 last. Buses that were in operation prior to that date will continue under municipal restrictions. This measure is the outcome of a long fight between the street railway company operating in Newark and nearby cities and the motor buses in these cities. More motor buses are in operation on the streets of Newark than in probably any other city in the world.

Nevada

The Assembly on March 18 passed the bill authorizing the counties of Elko, Pershing, Humboldt and Washoe to issue bonds for the construction of a highway across northern Nevada. Washoe and Elko Counties will each issue $150,000 of bonds and Humboldt and Pershing Counties each half this amount. The bond issues are contingent upon an equivalent appropriation from California counties and the securing of $900,000 of federal aid.

New York

No. 1112, introduced in the Senate by Mr. Knight, provides that gasoline sold in the state must have a boiling point not higher than 60° C.; 12% must distill below 105° C, 50% below 140° C, "90% below 100° C, or 374° F.;" not less than 95% of the liquid when tested must be recovered in the receivers; the dry point of distillation must not be higher than 225° C. (The part above included in quotation marks is copied from the bill and should apparently read 208° C.)

No. 1127, introduced in the Senate by Mr. Lowman on March 15, provides that any county contract for highway improvement which was terminated by the State Commissioner of Highways under Chapter 449, Laws of 1919, but for which the right of way was secured and the money appropriated by the county, shall be constructed by the county with state aid.

No. 1481, introduced in the Assembly by Mr. Cole on March 15, provides that motor buses carrying more than ten passengers shall be equipped with fire extinguishers.

No. 1486, introduced in the Assembly on March 15 by Mr. Walsh, forbids the use of colored lights "attached to the front of any vehicle."

No. 1586, introduced in the Assembly on March 18 by Mr. Judson, provides that losses sustained under contracts for public improvements let prior to April 6, 1917, and due to the war, are just claims against the state and its political subdivisions. The amount of loss to any contractor is to be determined by any court of competent jurisdiction.

No. 1241, introduced in the Senate on March 21 by Mr. Lowman, provides that motor vehicle fines collected for violation of local ordinances shall be turned over to the state treasurer.

No. 1242, introduced on March 21 in the Senate by Mr. Lowman, provides that counties shall use their share of motor vehicle fees on state aid county roads.

No. 1244, introduced in the Senate on March 21 by Mr. Hewitt, appropriates $7,964,747.75 for payment by the state in the first instance of the Federal Government's share of cost of construction of federal aid roads.

No. 1658, introduced in the Assembly March 24 by Mr. Harrington, provides that contractors' bonds shall state that all laborers will be paid in full at least once a month.

The Senate on March 23 passed three bills, Nos. 899, 900 and 959, carrying an aggregate of $9,599,676 for road work. (See Good Roads, of March 23, 1921, for provisions of these bills.)

On March 24 the Assembly passed the annual maintenance and repair bill appropriating $7,500,000 and the bill appropating $5,250,000 for the improvement of rural post roads. (See Senate Bills Nos. 959 and 919.)

Ohio

The Ripper Bill, providing for the consolidation of administrative departments, has been amended so as to place the superintendent of public works under the director of highways.

Oklahoma

A bill has been introduced in the Senate appropriating $3,000,000 for road construction during the next two years.

On March 10 the Senate passed the House bill providing that road supervisors shall receive $5 per day, but may not claim more than 150 days of work in a year.

A measure permitting the sale of the $750,000 of road bonds of Oklahoma County below par, and amended to include Muskogee, Okmulgee and Bryan Counties, has passed both houses of the Legislature. This bill applies only to bonds already voted and provides that the bonds shall sell for not less than 93.

Oregon

S. B. No. 354 provides that counties or parts of counties may combine into bonding and taxing districts to construct highways in cooperating with the state. This bill passed the Senate by a vote of 17 to 13. An election to determine whether a road district is to be formed will be granted upon a petition of 2% of the registered voters in the proposed district.

S. B. No. 355 has been introduced by the Senate Committee on Roads and Highways and directs that the State Highway Commission proceed with the sale of the $2,500,000 of bonds and build the Roosevelt Highway as rapidly as the state money is matched by local money.

S. B. No. 365, introduced at the request of Governor Olcott, provides that the State Highway Commission may acquire land 200 ft. wide on each side of any highway. This bill was introduced so as to enable the commission to beautify the roadsides. The bill passed the Senate.

Pennsylvania

The Eyre Bill, providing for the issuance of long term bonds with higher interest in exchange for outstanding short term road bonds, was amended in the Senate on March 21 by the provision that if the new

(Continued on page 214)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

E. L. POWERS
Editor

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Managing Editor

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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RESTRICTING TRAFFIC IN SPRING AND FALL

In the spring and fall of the year when the frost is leaving or entering the ground, excessive and heavy traffic does considerable damage to the lower types of roads, which, incidentally, make up about 85% of the total road mileage of the country. Very likely the traffic during a few weeks in the spring and fall damages the roads more than does the traffic throughout the entire remainder of the year. This is due to the large amount of moisture present, which causes an unstable physical condition characteristic of soil at these periods. Heavy vehicles cut deep into the road and grind the material into a semifluid mass. This is particularly true of roads built of silicate soils, which churn under traffiic into a gelatinous mass, apparently of colloidal nature.

The barring of heavy vehicles from earth, clay and gravel roads for a short time during the spring and fall not only helps to preserve the roads, but also very materially reduces maintenance costs. A few states have made regulations to this effect at various times, but there does not seem to be any general appreciation of the great damage which may be inflicted upon roads during the critical periods of spring and fall. Surely, if the users of these roads were shown that barring of heavy traffic for a few weeks would make better highways for the rest of the year, they would welcome the restriction of heavy traffic during brief periods in the spring and fall.

SELLING ROAD BONDS

In view of the fact that state, county and city highway bonds are exempt from taxation, it would seem that securities of that nature would be sought eagerly by those who see their incomes encroached upon by the income tax. That this is at least partly the case is evidenced by a statement made by H. C. Sylvester, Jr., Vice President of the National City Company of New York, N. Y., at the 1921 convention of the American Road Builders' Association. He said:

"In twenty years' time I have never known the public any more interested in tax exempt bonds than they are today—the big as well as the small investor. I do not believe that there ever has been a bigger and broader market for state and municipal bonds than there is today."

Notwithstanding this market for tax exempt bonds, states and counties are experiencing great difficulty in marketing their bonds. The State of Michigan needs funds, yet the bankers of that state recently refused to take up a $5,000,000 issue of road bonds bearing 5% interest unless the rate were raised to 5.5%. Pennsylvania, California and other states have yielded to the demands of the bankers and it is likely that Michigan will be forced to do likewse.

When it is taken into consideration that the bonds authorized for road improvement amount to only about $900,000,000—which is less than any one of the several Liberty Loans floated during the war—it is difficult to understand why road bonds find so poor markets, especially in view of the fact that the United States is "sold" on good roads. The situation becomes still harder to understand when the advantages accruing to holders of tax exempt bonds are taken into account. It would be reasonable to expect such issues to find a ready market at rates of interest considerably lower than the rates on taxable securities. Yet such is not the case.

If the bankers of the country are hamstringing the road building program of the country by refusing to buy the most desirable and most eagerly sought securities at reasonable interest rates, why can not the bankers be eliminated from the marketing of highway bonds by the direct selling of the bonds by the states and counties? In some sections of the country this plan has been followed—and with marked success. Last year the City of London, Canada, with a population of 60,000, sold $400,000 worth of bonds over the counter to its own citizens. If Michigan, instead of begging the bankers to take a block of $5,000,000 worth of tax exempt highway bonds, would offer them to its citizens, providing bonds of small denominations and making the purchase of them no more complicated than the buying of a Liberty Bond at a bank, it is more than likely that the bonds would be sold and an end would be put to the likelihood of a suspension of the road improvement program because of the lack of funds.

Testing and Laboratory Control of Large Highway Contracts

(Concluded from page 204)

a satisfactory character" or "meeting the approval of" should be eliminated. What may be satisfactory to one engineer may not meet with another's approval, so that unless a contractor knows what to expect of the engineer, the price bid must be based on the use of first class materials—which naturally increases the price.

The methods used in determining whether or not materials or products comply with the requirements vary greatly in different localities. It is usual to take samples needed for this purpose at the point of use. This decreases the cost of inspection and testing, but certainly does not accelerate construction. Contractors should not use materials of doubtful quality nor should producers ship materials they know to be below standard, yet we know that both are done. Such materials can be rejected at the point of use, but it is very costly and unsatisfactory to all concerned to do so. We are constantly told by outsiders that a few examples should be made of such contractors and producers in order to demonstrate to others what they may expect if they try a similar procedure.

This method of preventing the use of inferior grades of materials and products has been tried to a limited extent by the Department, but has not given the results desired. The usual paving or road building contractor confines his efforts to that kind of work, therefore deriving the larger part of his income from it. What is lost on one contract must be made up on the next, and a higher bid is the result. The contractor may be the immediate loser, but the "party of the first part" eventually pays the bill.

This method of judging materials delays the work besides increasing the cost. The traveling public hasn't time to examine a good pavement very closely. But since the rate of progress over the bad ones is fairly limited, people have more time to examine and judge them and it is to be expected that they will form a more definite opinion regarding them. They also have become expert judges of detours. These detours they never appear to forget, even if the scenery is fascinating and their time for observation is necessarily much longer than on an improved road. Therefore, it is both advisable and diplomatic to reduce the use of detours to the minimum. In general, the public is only indirectly interested in how roads are built, the materials used, detours, disputes between the contracting parties, etc. They are, however, vitally interested in having good pavements and having them constructed as quickly and cheaply as possible. Therefore, if the public is to be pleased, delays must be reduced to a minimum, which means that every effort must be made to help the contractor and not delay his work by rejecting materials at the point of use. In order to prevent such delays and the resulting expense, a different method of approving materials will have to be adopted. With this end in view, it is the intenton of the Department to divide inspectors into two classes—construction inspectors and material inspectors. The latter will have nothing to do with construction, but will be placed at points where materials are being produced and will accept or reject them before shipment. The contractor and the Department will be notified, upon special forms, of all materials thus accepted or rejected and the inspectors will be held responsible for all materials accepted and rejected. They will be given special training for their duties and will be equipped wth the apparatus necessary for making field tests. They will also be expected to see that orders are promptly filled on state and state aid work, and the Department notified of any reasons preventing prompt shipment of materials. By this method all demurrage charges should be eliminated and the producer will be saved the additional freight charges and other expenses due to rejections at the destination. In addition, the contractor will be saved the expense that usually occurs when his work is interrupted or stopped.

This method certainly will shorten the construction period and the use of detours and should lower the cost of the work. Naturally, it will result in a large increase in the cost of testing, for the material inspectors at points of production will be under the jurisdiction of the laboratory and their expenses will be charged to the testing department. However, it is the writer's belief that the reduction in the cost of construction will amount to much more than the additional expense incurred, with a consequent saving in the net cost of construction.

In conclusion, the writer would like to again state that failures in construction due to the use of inferior grades of materials or materials not suitable for the purpose should be eliminated wherever possible; also that delays in construction are very expensive, which expense is eventually paid by "the party of the first part," and everything possible should be done to eliminate these delays and help the contractor in his work. If first class pavements are to be constructed and their cost kept to the minimum, the contracting parties must work together for the best interests of all concerned.

The Educational Activities of the Permanent Committee

(Concluded from page 206)

roads being destroyed by heavy motor trucks, the first thought that comes to those responsible for keeping up the roads is to enact legislation which will limit the size and weight of vehicles. On the other hand, those who manufacture and operate trucks desire to get the maximum possible load and they are insistent in their demand for highways built accordingly. The proper balance between the two, (and these divergent interests are certainly far apart at the present time!) is an economc problem which looms large. It goes to the very bottom of our proud system of free highways for all citizens, and it should have the most careful consideration by the best brains of the country.

Closely related to legislation regarding the construction and maintenance of highways is that of traffic regulation. With increasing speed as well as increasing numbers of vehicles, the problem of safely handling traffic in large cities is a serious one. It is one which might well be taught not only for the sake of safety in the lower grades of schools, but also as a fascinating science in colleges and universities. The science of highway traffic regulation is as intricate as that of trigonometry and could be made to furnish as good mental training to college students. It has also the advantage of being a live science, bringing in as it does the human factor to a marked degree. So far only one book has been written on this subject, and this by a man who has devoted nearly twenty years of his life and a large part of his fortune to this particular subject for the welfare of his fellowman. It is a science in which there are unusual opportunities for research and it promises a very considerable amount of change before it is reduced to a satisfactory basis.

These, in brief, are some of the more pressing topics with which the Permanent Committee will be concerned. Its function is to help in any way possible, and wherever it may, educational activities for the better understanding of highways and greater efficiency, comfort and safety in their general use.

Economics of Highway Construction

(Concluded from page 208)

the economic principles mentioned have been observed, then, as the maintenance charge increases with the increase in traffic, it will be an economic measure to resurface with a harder or heavier material. It will not be necessary, as is now so often the case, to tear up an old macadam or gravel base and replace it entirely by another material, but it can be used as a foundation for a bituminous macadam or concrete or even cement concrete surface, thus securing results at the minimum expense. The maintenance of roads costs money, just as does the construction of roads, and a state or county must make laws that will insure efficient maintenance of its roads and must provide adequate funds for the work. This is a most important economic feature of our road work, for the question has already been raised amongst bond purchasers as to whether or not they will purchase bonds issued for road construction and improvement when the maintenance of the roads so constructed is not provided for by law.

Information that is very much needed by highway commissions consists of accurate traffic records on at least all the state roads. This information is needed as a guide in determining not only the type of surfacing to use, but also as a guide in regard to maintenance.

The most complete economic success in highway construction in any state will be assured only when minute attention to detail is a part of every step of the work—maintenance as well as construction.

Unemployed Miners Work on Highways

About 200 unemployed miners and others have been working on Oklahoma roads, according to Richard Jenkins, Secretary of the Tri-State Zinc Institute. Payment to the men is made in labor certificates which are good for groceries at the stores and redeemable at the office of the relief organization.

Canadian City Markets Own Bonds

Municipal Debentures Sold Direct to the Citizens — Small Sums Also Received and Credited Against Future Issues, Thus Reducing Amount of Short Term Bank Loans

Last year the City of London, Ont., Canada, adopted the plan of selling its securities directly to its citizens and the plan has met with great success, the city selling $400,000 worth of bonds.

"Under the new arrangement," writes B. H. Penny in the "Canadian Municipal Journal," "city debentures are sold directly to citizens instead of finding their way to the public through bond houses. Municipal debentures are found to make a strong appeal to the smaller investors. They have as much confidence in them as in government Victory Bonds. The facilities now for investing in debentures on any business day of the year are making practically every citizen a bond holder.

"When authorized debentures are not available the city treasurer accepts money for which he issues a receipt. This is used for current expenses, reducing the amount of short term loans which it is necessary to make from the banks each year until municipal taxes are collected. As soon as a debenture issue is authorized, the money is applied to its account and the bonds issued for the receipts. This policy has the effect of keeping the market for city debentures always open."

MEETINGS

Calendar of Coming Meetings

April 18-23—United States Good Roads Association.—Ninth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 29—National Highway Traffic Association—Annual Convention, Detroit Athletic Club, Detroit, Mich. Secretary, Elmer Thompson, 247 W. 54th St., New York, N. Y.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12.—Canadian Good Roads Association.—Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

PERSONAL MENTION

R. E. Caldwell has been appointed state engineer of Utah.

G. S. White was recently appointed city engineer of Fort Morgan, Colo.

W. L. Affleck has been appointed city engineer of Nelson, B. C., Canada.

Calvin E. Cock has been appointed engineer of Cherokee County, Texas.

G. R. Wade has resigned as county engineer of Imperial County, California.

Thurman W. Dix has been appointed state highway engineer of Vermont.

R. Y. Watson has been appointed county engineer of Imperial County, California.

H. B. Cassin has resigned as assistant engineer of Jefferson County, Kentucky.

J. C. McLean has been appointed county engineer of Woodbury County, Iowa.

J. J. Jessop has resigned as consulting engineer of Imperial County, California.

Current Highway Legislation—III

(Continued from page 210)

bonds command a premium in the market, the holders of the short term bonds will pay the margin to the state.

Rhode Island

Senator McMeehan has introduced a bill which provides for the appointment of a special committee to secure plans and estimates for a new bridge to replace the Washington Bridge across the Seekonk River.

South Dakota

The first highway bill to get consideration at this session fixes a single tax on motor vehicles, based on weight. The bill has passed the Senate.

Washington

On March 2 Governor Hart signed two highway measures, one authorizing the State Highway Commission to adopt primary highway routes, the other changing the name of McClellan Pass Highway to Naches Pass Highway.

The Senate has passed the road appropriation bill which carries $12,490,000 and it has been signed by Governor Hart. Of this sum $2,800,000 is appropriated for the maintenance of primary highways and $9,690,000 from the public highway and motor vehicle funds for the construction of primary and secondary highways.

(To be continued)

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of "GOOD ROADS," published weekly at Jamestown, N. Y., for Apr. 1, 1921.

State of New York, County of New York, ss:

Before me, a Commissioner of Deeds in and for the state and county aforesaid, personally appeared E. L. Powers, who, having been duly sworn according to law, deposes and says that he is the Editor and Business Manager of "Good Roads," and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—The E. L. Powers Co. (Inc.), 11 Waverly Place, New York, N. Y.

Editor—E. L. Powers, 11 Waverly Place, New York, N. Y.

Managing Editor—T. A. Hulbert, Jamestown, N. Y.

Business Manager—E. L. Powers, 11 Waverly Place, New York, N. Y.

2. That the owners are:

E. L. Powers, President and Treasurer, 11 Waverly Place, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)

E. L. POWERS, Editor and Bus. Mgr.

Sworn to and subscribed before me this 28th day of March, 1921.

(Seal)

O. D. CONKLIN,
Commissioner of Deeds, N. Y. C.
(My commission expires June 15, 1922.)

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PERSONAL MENTION:

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time a fabric of steel must be incorporated in the concrete.

Several great States have so ruled.

American Steel and Wire Company's

Concrete Reinforcement

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

WITH WHICH IS INCORPORATED

THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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JAMESTOWN, N. Y., APRIL 20, 1921

Number
16

Where to Use Guard Rails *

Have Engineers Neglected Safety Considerations in Highway Work?—Conditions Requiring Erection of Guard Rails—How Rails Should be Built—Methods of Eliminating Guard Rails

By W. W. COX†

Since the advent of the automobile as a necessary means of transportation, and since the more recent development of the motor truck as a necessary means of hauling freight, many new problems have confronted road builders. As the volume, weight and speed of traffic increases, so also must the road builder increase his efforts to meet those conditions, so that the maximum service may be obtained from our highways.

New and revised laws are enacted to regulate speed and weight; new and more rapid means of construction are adopted to facilitate the completion of roads; stronger foundations and better surfaces are designed and constructed; new alignments are made; all for the purpose of improving our highways.

Notwithstanding the advances in legislation, design and construction, have we not, as road builders, overlooked the necessity of providing proper safeguards for the protection of life and property? Have we not failed to give this phase of construction sufficient thought and attention? In other words, has the subject of guard rails been studied, so that when certain conditions prevail, we make them an important part of our construction requirements?

It is conceded by the writer that the use of guard rails will not entirely remove elements of danger, nor will their use absolutely solve the problem of protection. But let us examine the conditions under which they can be used to distinct advantage.

On a road where the hard surface or traveled way is narrow, say 9 ft. wide, and the grade is 20 to 24 ft. wide, where the shoulders or berms are of light sand and soil or where they are of heavy clay, many accidents are sure to result from skidding when vehicles pass. Especially is this the case with fast moving and heavy vehicles. This skidding and ending in upsetting in the ditch you may attribute to the carelessness of the driver, but let me ask: Have you ever driven a speedy automobile or a heavily loaded truck on soft or slippery shoulders? If you have, you will agree that even though average care and judgment are used accidents are sure to come where narrow surfaces and poor shoulders exist. These accidents may be more or less expensive, though not fatal. Fatal accidents usually result when the ditches are deep or when the fills are high. As a general rule, it is considered advisable to use guard rails where the ditches are over 4 ft. deep and where the fills are over 4 ft. high.

On roads where the traveled track or hard surface is 16 ft. wide and the grade is 24 to 30 ft. wide, accidents are not so numerous unless the surface is rough and the traffic is too congested. However, as traffic increases we find that the number of accidents increases proportionately.

On roads where the traveled track or hard surface is wide enough to accommodate traffic, so that vehicles may pass freely and without getting off the surface to do so, the dangers of skidding to the ditch are eliminated. This holds true except when rain, snow or ice literally greases the skids.

All roads, by virtue of their traffic conditions and by virtue of the difficulties encountered in their design and construction, do have their danger points and death traps where protection should be provided.

The most common of these is found in flat clay sections where deep drains become imperative for the improvement of the road and the adjacent farm lands. These ditches vary in depth from 3 to 12 ft.

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*Paper presented at the Seventh Annual Conference on Highway Engineering and Highway Transport of the University of Michigan, Ann Arbor, Mich., Feb. 21-25, 1921.

†Engineer-Manager, Board of County Road Commissioners, St. Clair County, Michigan.

and very often follow along the road for miles. In these sections we find the customary township line offsets where existing drain improvements prohibit new locations. Where intersecting roads or right angle turns must remain near these ditches it is necessary and advisable to protect the corners or turns.

In the rolling or hilly sections high fills must be made in order to reduce the grades. These fills, either of sand or clay, are subject to washouts and settlement, thus becoming dangerous when over a few feet high unless they are made exceptionally wide. Even the wide grade is treacherous if it is located on a steep gradient. In hilly territory we also find that the majority of curves cannot well be eliminated. These curves may be connected by long or short tangents. They may be long, easy curves or they may be short and sharp. Where possible, they should be superelevated and widened within reasonable limits. Whether or not they are long and easy, or short, or whether or not they are connected by long or short tangents, they are the most hazardous when they occur on steep gradients. Without question, curves in hilly territories should be guard railed properly. You may inquire: What do we place danger signs for? We place danger signs as a warniing and guard rails as a guide for the stranger and as an added safeguard, even though curves are wide and easy.

Approaches to bridges and culverts should also be protected. More especially is this true when the roadway is narrowed at these structures or when high water is likely to disturb the fills.

Guard rails should always be used when there is a question of safety involved, and when used they should be made strong and substantial. They may be constructed of rock in places where proper rock is obtainable to make a strong and pleasing rock wall. Reinforced concrete may be pre-cast and assembled into one firm, strong, pleasing structure. Guard rails which are most common in this section are constructed of timber. The latter should be built of 8-in. cedar posts placed not more than 8 ft. apart. The posts should be set into the ground not less than 3 ft., or deeper in loose soils. They should be placed not at the outer edge of the berm or shoulder, but within it and at least 1 ft. from the beginning of the side of the slope.

The side rails, usually three in number, should be of good clear lumber, not leess than 2 in. thick and 8 in. wide. These shoud be thoroughly spiked and lag screwed to the posts. The lower rails should be on center a distance of 15 in. from the ground. The top rail should be placed on top of the post so as to show up well, to strengthen the structure and to protect the top of the post from decay. The height of the structure should be not less than 3 to 4 ft. The whole should be painted with a good grade of white lead and oil paint.

You no doubt have considered already the cost of guard rails on some roads where you think the expense is almost prohibitive. Also you no doubt have estimated the price of maintenance and replacements. You have found them high priced and as a result of these costs you probably have omitted them where protection is badly needed.

Perhaps you have been designing and constructing your roads, bridges and culverts so as to eliminate the guard rail wherever possible.

Since we are considering this subject, it might be well to consider also how guard rails may be eliminated.

Where deep ditches and sharp turns are in existence we shall find on investigation that in many instances it would be better and more economical to purchase additional right of way. We then could build our roads with wider grades and at a safe distance from the ditches.

At the present price of guard rail one mile would cost $5,000 or $6,000, for one side of the road. This sum would in many cases pay for the right of way and also provide for the wider grade. Usually culverts can be made the full width of the grade with money which would be put into guard rails.

After eliminating them wherever possible, consistent with economy, there still remain places that should be guard railed. It occurs to me that if we as road builders consider our responsibilities seriously, we should give to the public every reasonable means of protection. When accidents occur on our highways we should be able to feel that we are not guilty of negligence.

The traveling public, as well as the public at large, is looking to us to not only construct our roads for the users, but they also expect and will demand that we make hem safe under reasonable conditions.

National Grange Studies Federal Aid Legislation

Committee on National Highway Legislation Sends Questionnaire to Highway Officials of the States to Learn Attitude Towards Changes in Present Law and Additional Aid

A letter asking for information on the operation of the federal aid law and for expressions of opinion as to changes in it, including an increase in the amount of aid extended, has recently been sent out to state highway officials by Thomas C. Atkeson, Washington Representative of the National Grange. The text of the letter follows:

At the request of Senator Charles E. Townsend, of Michigan, during 1919, a committee representing the National Grange, United States Chamber of Commerce, American Automobile Association, National Automobile Chamber of Commerce, and Federal Highway Council, was formed for the purpose of cooperating in the preparation of legislation looking to appropriate federal roads legislation.

Senator Townsend has requested this committee to collect information which might be useful in amending the present federal aid act and in facilitating the passage of some measure providing for the construction and maintenance of a system of interstate highways.

The committee, therefore, wishes to obtain from state highway departments answers to the following questions:

1. Are you confining the expenditure of federal aid funds to a selected system of inter-county state roads?

If so, what is the mileage of the state system and its percentage of the total road mileage in your state?

2. Do you consider it wise to expend federal aid funds on the grading and drainage of roads over clay or alluvial soils in the humid sections of the United States without providing at the same time for an adequate hard surface of gravel or better, so that the roads will be suitable for travel at all seasons of the year?

3. Are the funds used in meeting federal aid in your state contributed by the state, or by the counties, or both; and is any money taken from the motor vehicle fees?

4. Are the roads on which federal funds are spent in your state maintained by the counties, or by the state, or by the counties under state supervision?

5. In case additional federal aid is granted by Congress:

(a) Would your department favor confining the federal funds to a limited system of inter-county state roads, selected by state and federal authorities?

(b) Do you think that your state would be willing to provide the funds and to assume absolute responsibility and control over the maintenance of all federal aid roads in your state without calling upon the counties for financial assistance?

(c) Do you believe that a percentage of the federal aid allotment to each state should be set aside for the maintenance of previously constructed federal aid projects in the various states, to be met with state funds in the same proportion as allotted for construction?

(c-1) If not, how would you suggest that money be provided for the adequate maintenance of federal aid roads?

(d) Do you think that the Legislature of your state would provide state funds to meet federal aid without calling upon the counties for financial assistance in the construction of all federal aid projects?

6. In the event that additional federal aid is granted for a limited period of years along the lines indicated by the above questions, do you thing that the people of your state would favor a federal system of interstate roads laid out by federal highway authority in cooperation with state highway departments as to location, construction, and maintenance, all expenses connected therewith to be borne by the Federal Government, the work to proceed in each state as nearly as possible at the same time?

Replies to these questions, at your earliest convenience, will be greatly appreciated by

Very truly yours,

(Signed) THOMAS C. ATKESON,

Washington Representative National Grange.

Illinois Lets Road Contract Under New Plan

Modified Cost Plus Contract Let for the Building of 15 mi. of Road in Kane County

On April 5 Illinois awarded a contract to the McCall Construction Co. for the construction of 15 mi. of road in Kane County. Under the agreement the construction company agrees to build approximately 15 mi. of road for $345,000, the total cost per mile to the state not to exceed $29,975. The company agrees to construct the road at cost plus 15% and if this amounts to less than $29.975 per mile the state will benefit by the difference. Satisfactory personal bonds will be given, thus relieving the contractor from paying 1½% for bonding.

President Harding on Good Roads*

Roads Lines of Motor Traffic in Interstate Commerce—Motors Indispensable—Need for Avoiding Abuses, Strengthening Federal Aid Law and Conditioning Aid Upon Maintenance

Transportation over the highways is little less important (than rail transportation) but the problems relate to construction and development, and deserve your most earnest attention, because we are laying a foundation for a long time to come, and the creation is very difficult to visualize in its great possibilities.

The highways are not only feeders to the railroads and afford relief from local burdens, they are actually lines of motor traffic in interstate commerce. They are the smaller arteries of the larger portion of our commerce, and the motor car has become an indispensable instrument in our political, social and industrial life.

There is begun a new era in highway construction, the outlay for which runs far into the hundreds of millions of dollars. Bond issues by road districts, counties and states mount to enormous figures and the country is facing such an outlay that it is vital that every effort shall be directed against wasted effort and unjustifiable expenditure.

The Federal Government can place no inhibition on the expenditures in the several states, but since Congress has embarked upon a policy of assisting the states in highway improvement, wisely, I believe, it can assert a wholly becoming influence in shaping policy.

With the principle of federal participation acceptably established, probably never to be abandoned, it is important to exert federal influence in developing comprehensive plans looking to the promotion of commerce, and apply our expenditures in the surest way to guarantee a public return for money expended.

Large federal outlay demands a federal voice in the program of expenditure. Congress cannot justify a mere gift from the federal purse to the several states to be prorated among counties for road betterment. Such a course will invite abuses which it were better to guard against in the beginning.

The laws governing federal aid should be amended and strengthened. The federal agency of administration should be elevated to the importance and vested with authority comparable to the work before it. And Congress ought to prescribe conditions to federal appropriations which will necessitate a consistent program of uniformity which will justify the federal outlay.

I know of nothing more shocking than the millions of public funds wasted in improved highways, wasted because there is no policy of maintenance. The neglect is not universal, but it is very near it. There is nothing the Congress can do more effectively to end this shocking waste than condition all federal aid on provisions for maintenance. Highways, no matter how generous the outlay for construction, cannot be maintained without patrol and constant repairs. Such conditions insisted upon in the grant of federal aid will safeguard the public which pays and guard the Federal Government against political abuses, which tend to defeat the very purpose for which we authorize federal expenditure.

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*From President Harding's message to the 67th Congress.

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Current Highway Legislation—IV

Lawmakers in Various States Consider Measures Relating to the Organization of Highway Departments and Financing Road Work

(Continued from April 13)

The legislative season is drawing to a close, most of the state legislatures having adjourned, while others are winding up the business now before them. Much of the legislation pertaining to motor vehicles introduced this year aims to impose greater taxes upon them. In addition, several bills have been introduced which propose state taxes on gasoline.

The following report contains notes on additional bills introduced and action taken on bills already introduced.

California

A bill was recently introduced providing for a tax of 1 ct. per gallon on gasoline and fuel oils used in motor vehicles.

Connecticut

A bill has been introduced in the Legislature providing for the abolition of tolls on trunk line highway bridges.

Delaware

The House has passed a bill authorizing Sussex County to borrow $1,000,000 to be used in highway improvement.

The House has stricken from its calendar the bill establishing a chair of highway engineering at Delaware College.

Illinois

The Holaday Bill, providing that counties may construct their own roads, passed the House on March 31 by a vote of 31 to 0.

A joint resolution has been passed by the Legislature calling for a committee of three from each house to investigate the road situation in the state.

Indiana

A bill fixing the salaries of county surveyors in counties having a population of more than 200,000 at $4,500 a year has passed the House. Deputy surveyors will get not more than $200 per month.

A bill providing for the registration of engineers and surveyors has become a law.

Louisiana

The Committee on Roads and Drainage of the Constitutional Convention is holding hearings on proposed methods of building a state system of highways. J. Y. Sanders, Chairman of the Committee, favors a plan of securing funds from motor vehicle fees, a tax on gasoline, an ad valorem tax on motor vehicles and federal aid. Revenue from these sources would yield about $4,000,000 annually.

Michigan

A bill has been introduced in the Legislature which raises the interest rate on state highway bonds from 5 to 5½% and permits the issuance of $10,000,000 of highway bonds annually by the state, instead of $5,000,000 as at the present time. Despite the fact that these bonds are exempt from taxation, the state finds difficuly in selling them at 5% interest. Until recently, it is reported, similar bonds always brought a premium with interest from 4 to 4½%.

New Hampshire

The governor has signed a bill which gives the motor vehicle commissioner authority to limit the weight of vehicles on the highways.

New Jersey

The Assembly on March 29 passed the Downs Bill providing for a $50,000,000 road bond issue.

The Parry Bill providing for open specifications in road work has been defeated.

New York

On March 30 Governor Miller signed the Lowman Bill amending the highway law so as to permit the exemption of certain sections of town roads from local ordinances.

The Hewitt Bill appropriating $5,000,000 toward the construction of the Hudson River vehicular tunnel has been passed by both houses.

Ohio

A bill has been introduced by Representative Miller which provides that each county of the state

(Continued on page 224)

GOOD ROADS

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI APRIL 20, 1921 **No.** 16

CITY HIGHWAY PROBLEMS

Important investigatons are now being carried on by the U. S. Bureau of Public Roads which will open the way for the solution of many of the problems now confronting the road builder. The problems of bearing power of various soils in connection with their ability to support pavements, the relative service values of pavements, the effects of vehicular impact upon pavements, the capillary movement of moisture, and similar questions are being studied. Already these investigations have led to a better understanding of many of the problems of highway engineering.

While the principles involved in the researches on pavements are the same for both rural and city pavements, there are certain problems peculiar to cities which might well be studied by the bureau. The problems of street widths, street location, traffic regulation, snow removal, etc., are very important to the cities of this country. A city may spend a million dollars with only partial success in attempting to clear its snow-bound streets.

The U. S. Bureau of Public Roads is better fitted to find solutions to many of these problems than are the cities themselves, working individually. It maintains a large staff of experts and can draw upon the knowledge and experience of the entire country. Unfortunately, at the present time its funds for research are limited. But it is greatly to be desired that the U. S. Bureau of Public Roads be provided with sufficient funds and its scope of activities enlarged so as to include the investigation of city as well as rural highway problems.

ROADS DISCUSSED IN PRESIDENT'S MESSAGE

President Harding's discussion of road work in his message to Congress indicates an understanding of the highway program that augurs well for the administration of federal aid during the next four years.

Starting with the premise that highway transportation is little less important than rail transporation, he points out the magnitude of the country's improvement program, emphasizes the need of careful disbursement of the nation's money and of a strengthened federal aid law, and concludes by recommending that grants of federal aid be conditioned upon the proper maintenence of the roads on which it is used in order to avoid the enormous waste arising from the failure to take proper care of good roads after they have been built.

While President Harding's main points—the economic importance of highways, the need of a stronger federal aid law, and the necessity of insuring the maintenance of roads—are fully appreciated by engineers, the Congress and the general public do not realize how essential they are.

The country is committed to a gigantic road program, including federal participation, which, as President Harding expresses it, is "acceptably established, probably never to be abandoned." If federal aid works out as state aid has—and there is every reason to expect that it will—this means that Congress will be asked for larger and larger appropriations, which will be made if Congress is convinced that public sentiment is unmistakably behind the demand.

Under such circumstances there hardly could be any honest difference of opinion as to the necessity of adequate administrative machinery within the Federal Government. That means not only that the present law should be strengthened, but also, again quoting the President, that: "The federal agency of administration should be elevated to the importance and vested with authority comparable to the work before it."

The danger of grave abuses in the operation of the federal aid principle is frankly admitted by President Harding, for he points out that merely to apportion money from the federal treasury would "invite abuses which it were better to guard against in the beginning." This is a potential evil and an avoidable one. But to avoid it surely, all federal aid legislation must be drawn most carefully, every possible safeguard being thrown around the allotment of funds. Nothing would do more to retard progress in road improvement than would the sinking of federal aid to the pork barrel level of rivers and harbors and public buildings legislation.

Delaware Has Small Road Fund

The Delaware State Highway Department expected to have about $2,000,000 available for road work this year, but it has been found that according to the construction of the recent highway appropriation act of the Legislature, only about $1,000,000 will be available this year. The departmert had planned to do considerable road work, but must curtail its program because of lack of funds.

New York State Repair Gangs to be Replaced by Patrolmen

With the explanation that the repair gang system introduced by former Commissioner Greene did not give satisfaction, State Highway Commissioner Sisson of New York has announced that several hundred road patrolmen will be appointed in the various counties. Commissioner Sisson, it is reported, has advised each Republican senator to make a certain number of recommendations for these positions. The abolition of the gang system is the first radical change effected in the highway organization since Commissioner Sisson took office.

Senate May Probe Road Situation

Resolution in Senate Charges "Waste and Extravagance" and Calls for Appointment of Committee of Three Senators to Carry on an Investigation of the Whole Matter

On April 12, the second day of the extra session of Congress, Senator Harrison read a resolution by Senator King calling for an investigation of the highway situation. The King resolution is sweeping and in the preamble it is explained that it is introduced as a result of charges involving "waste and extravagance" in the expenditure of federal aid funds which "to a great extent have been and are being dissipated without adequate returns in work accomplished."

"It is further charged," the resolution reads, "that impractical and extravagant projects for road construction have been formulated in the several states, which will require hundreds of millions of dollars for their execution and completion, and that some of the states have committed themselves to such extravagant projects upon the unauthorized information that federal money would be forthcoming for the completion of them."

The resolution calls for the appointment of three senators by the President of the Senate, and instructs the committee to go into every phase of the road problem. The committee would be authorized to hold sessions in all parts of the country and to summon witnesses.

Road Funds of Virginia

$4,000,000 Available for Construction in 1921, According to Commissioner Coleman

The State of Virginia has a total of $4,081,101 available for highway construction, as distinguished from funds available for maintenance and county aid, according to G. P. Coleman, State Highway Commissioner.

Contracts will be let early this spring to the full extent of these funds. A total of $1,800,000 is available for road construction in cooperation with the counties, provided the counties meet their allotments.

County's Right to Condemn Turnpike Upheld by Tennessee Court

By a recent Supreme Court decision, the Tennessee State Highway Department and Franklin County are upheld in the right to condemn the turnpike of the Franklin and Springhill Turnpike Co. In reviewing the decision of the lower court, the opinion stated that it recognized the contract rights granted in the charter of the company, but it was held that the rights and privileges secured to turnpike companies by their charters are merely property and like all other property are subject to the eminent domain power of the state government.

Federal Aid Roads Must Be Maintained, Says President Harding

State Highway Officials in Conference with President on Continuance of Federal Aid

The Executive Committee of the American Association of State Highway Officials conferred with President Harding and Secretary of Agriculture Wallace on April 14 on the continuance of federal aid appropriations.

President Harding stated that he was averse to the National Government contributing any considerable funds for construction when there was no assurance that the highways would receive proper care. Members of the Executive Committee concurred in his views and agreed to urge earnestly the adoption of such a policy by their respective states.

W. C. Markham, legislative representative of the association and secretary of the Kansas State Highway Commission, was spokesman for the delegation.

HIGHWAY TRANSPORTATION

The Economics of Highway Transport*

BY ROY D. CHAPIN†

In these times of readjustment, every American citizen is taking stock of his assets and liabilities. The war brought to our attention many new economic problems, and few more pressing than our investments in highways and highway vehicles. As an asset, both run into billions in money. As a liability, an enormous annual maintenance charge is involved. These charges are justified, but we must not neglect their importance. We are all too haphazard in our consideration of many new and urgent questions. Highway transport is one to give us pause and, touching each of us, make us think of the future. Who receives the benefit? You do. Likewise, who pays? You do.

Webster defines economics as the science that investigates the conditions and laws affecting production, distribution and consumption of wealth; or the material means of satisfying human desires.

Highway transport is intimately concerned with the production and distribution of wealth, and has become an outstanding means of satisfaction of human desires. Let us trace back into history how the movement of men and goods has steadily altered the map of the world. Why did the Phoenicians journey westward; Rome spread its roads over Europe; and Columbus set out restlessly across the Atlantic to finally discover America? Mankind wanted new means of expressing itself, sought new worlds to conquer, and, conquering them, brought back new thoughts, new habits, and new commodities. Steadily civilization has followed the opening of fresh trade routes. As the centuries went on, civilization and transportation became co-partners, moving down the ages hand in hand.

The invention of the wheel was the first great step in facilitating progress across country. Then came the compass, and mariners felt safe out of sight of land. The steam engine in boats and railroad trains satisfied in part that desire for quicker movement from point to point that is such an insistent characteristic of civilization.

However, the desire for individual expression in terms of rapid movement was not gratified until the inventors finally perfected the motor vehicle. Here was a new tool with which to create and transport wealth. More than this, it satisfied in unusual measure that wish that every man has had since the earliest days of history to move quickly, but when and where he pleased. He did not want to lean on schedules, but wished independence of action. It was now supplied him and a new and great chapter is being written in the progress of the world's civilization. Preconceived theories have gone by the board. Vistas of a new type of life have been opened to all of us. New laws must be written and in particular new economic laws that, taking cognizance of this suddenly developed Titan, will safely, sanely, and soundly conserve the billions of dollars the world has invested.

When Coumbus discovered America, he found the Indians knew nothing of the wheel, and their civilization had made little progress. Just as the Indians used the waterways, so did the earliest settlers in this country.

Washingtton, with that prophetic vision of his, realized that highways, both by land and water, must tie together the dwellers in this new country if it were to be truly united. He saw that trade routes must be opened to the Mississippi Valley, otherwise that section would align itself with New Orleans, then in foreign hands. His first move was to organize a company to build a canal between the Potomac and Ohio Rivers. The barrier of the Alleghenies must be removed. He was president of this canal company, and when the route was opened, it successfully accomplished its object. Later, while Washington was president of the United States, he opened the northern route via the Hudson River and Lake Erie, and so our present central states were made accessible to the seaboard.

President John Quincy Adams, too, was the firmest of believers in highways, and sought to make the Government responsible for the building of the main roads. He reached the same conclusion as Washington—highways served as an arterial system of the nation, and they should be built by the state and not private capital. Early in the 19th century we find regular service provided over the Boston Post Road between New York and Boston, over the route from New York to Philadelphia, Baltimore, Washington, Pittsburgh, from New York to Albany, and then over the Genesee Turnpike to Buffalo. The Government finally took a hand and began the construction of the "National Road" in 1811, which was projected to run from Cumberland, Md., to Columbus, Ohio, and Indianapolis, Ind. It was not finished through to Columbus until 1843, thirty-two years after its start. Plans were laid to construct other federal highways, and it looked as though canal, lake and highway transportation would be the means of opening up the West.

Birbeck, describing the traffic between Philadelphia and Pittsburgh, in 1817, says that: "Twelve thousand wagons passed that year between Baltimore and Philadelphia and Pittsburgh, to which should be added numerous stage coaches loaded to the limit and innumerable travelers on horseback, on foot and in light wagons, and you have a scene of bustle and business extending over the three hundred miles of road that is truly marvelous. The freight so handled over the road cost seven dollars per hundred-weight, or one hundred and forty dollars a ton." Even under the high freight rates today, transportation between these points costs but a fortieth of what it did then.

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*Paper presented at the Mid-Western Conference on Highway and Highway Transport Education, University of Michigan, Feb. 23, 1921.

†President, Hudson Motor Car Co.; Vice President, National Automobile Chamber of Commerce.

The northern states saw the importance of highway and canal building and this contributed astonishingly to their development. Between 1790 and 1830, Pennsylvania increased its population from 400,000 to 1,350,000; New York State from 340,000 to 2,000,000; Ohio from a few hundreds to almost a million. On the other hand, Virginia, with such a favorable early start in our history, was backward in her development of canals and highways, and increased only from 750,000 to 1,200,000.

However, a revolutionary change in transportation was at hand. Suddenly the railroad came forward as a medium of faster movement than anything then known, and very logically the nation turned its energies toward a great railroad expansion. Road building by the Government suddenly halted, and the highways gradually grew local in character, as the railroad builders drove their lines into every state. To our fathers and grandfathers had come a vision of the prosperity we have since known. Better transportation facilities were the keys to unlock this amazing store of wealth.

However, human desire once more asserted itself. Individual expression demanded individual transportation, and American inventive genius was the first to supply the low priced motor car and truck. We now see that our highway map must be rewritten and redrawn. No longer are the roads used for an average of 6 or 8-mi. hauls, as they were twenty years ago. Today your radius of highway action is unlimited, both for freight and passengers. Here is a new era making accessible every section of our country. We had learned that land values accrue in proportion to the accessibility of waterways and railroads. Now good highways add 100 to 1000% to land values, demonstrating that the user of the highway is not the sole beneficiary by its improvement. The distribution of wealth is greatly accelerated, education made easier, transportation costs lowered, and civilization given a new interpretation.

Yet the cost of all this is a tax upon every citizen. Let us look at the economic justification of our investment of $10,000,000,000 in vehicles, 2,500,000 mi. of highway, $700,000,000 available today for the building of roads, and an annual cost of maintenance of both vehicle and highway that would be staggering if it did not return many times this expenditure to every one of us.

(To be concluded May 4)

Motor Trucks in New York

Approximately one-eighth of all the motor trucks in use in the United States are operated by owners who live in New York State and almost three-fourths of all the trucks in New York State, or approximately one-ninth of all the trucks in the United States, are operated in New York City, thus making Gotham the most highly motorized city in the world.

The latest truck figures place the country's total at 900,000, of which more than 15,000 are state owned, more than 5,000 municipally owned and more than 80,000 farmer owned.

New Jersey Will Paint Poles Along Roads to Guide Traffic

The New Jersey State Highway Department has decided to have poles along the different routes on the state system painted this spring so as to indicate directions. Blue bands will denote north and south roads; red will denote east and west roads, and yellow will denote roads traversing the state in a diagonal direction.

It is also planned to whitewash all obstructions on the state highways, such as poles, trees, etc., which are situated within the graded width of the road and which extend 6 ft. from the ground. It is thought that this action will tend to reduce the number of accidents.

Automotive Interests Want a Federal Highway Commission

Representatives of automotive industries conferred with President Harding recently, urging that the expenditure of federal aid funds could best be carried on by a federal highway commission appointed by the president. The delegation was headed by Roy D. Chapin, Chairman of the Highways Committee of the National Automobile Chamber of Commerce.

California Motorists Protest Against Proposed Gasoline Tax

Motor Organizations from Entire State Unite to Oppose Any Increased Taxation

A conference was recently called by the California State Automobile Association, the Automobile Club of Southern California, the San Francisco Motor Car Dealers' Association and other motor bodies, to protest against the proposed state tax of 1 ct. per gallon on gasoline.

"The demand of the highway commission for new taxes aggregating $5,000,000 annually," said D. R. Faries, chairman of the conference, "in addition to taxes amounting to $5,666,625 imposed last year and a normal annual increase of approximately $1,500,000, has resulted in the commission being arrayed against a united automotive industry."

MEETINGS

Calendar of Coming Meetings

April 21-22—Bankhead National Highway Association.—Fifth annual convention, Greensboro, N. C. Secretary, J. A. Rountree, Birmingham, Ala.

April 29—National Highway Traffic Association—Annual Convention, Detroit Athletic Club, Detroit, Mich. Secretary, Elmer Thompson, 247 W. 54th St., New York, N. Y.

May 9-11—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12.—Canadian Good Roads Association.—Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

June 21-24.—American Society for Testing Materials.—Twenty-fourth annual convention, Asbury Park, N. J. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Associated Highways of America

The Associated Highways of America will hold its annual convention on Friday, April 22, at Tulsa, Okla. Officers for the next year will be elected and other business of the association will be transacted.

National Highway Traffic Association

The annual convention of the National Highway Traffic Association will be held on April 29 at the Detroit Athletic Club, Detroit, Mich. The convention will be devoted to the presentation and discussion of progress and final reports of standing committees. Included in the reports to be presented are the following subjects:

"Interrelationship of Highway, Railway and Waterway Transport"; "Traffic Limit Lines on Roadway Surfaces"; "Design of Curves at Street Corners to Facilitate Traffic"; "Widths of Roadways and Sidewalks in Municipalities"; "Highway Transport Clearing Houses"; "Regulations Covering Speeds, Weights and Dimensions of Motor Trucks and Trailers"; "Relative Efficiency of Different Types of Car Stop Safety Zones and Their Relation to Parking and Ranking Regulations"; "Regulation of Overloading of Motor Trucks"; "Traffic Center Lines on Roadways"; "Relation of Impact Forces on Pavements to Resulting Impact Forces on Vehicles"; "Status of the Construction of Highway Curves and Recommended Practice to Increase Safety to Traffic"; "Highway Transport Franchises"; "Motor Bus Service for Consolidated Rural Schools."

The Asphalt Association

The annual meeting of the Asphalt Association was held on April 13 in New York City with representatives from 87 asphalt firms in attendance. Besides the transaction of regular business, a number of resolutions were passed protesting against the waste of road funds and advocating the employment of idle men in carrying on road programs.

"To set this great army of one million men, now for the most part unemployed, at building highways," said J. R. Draney, President of the association, "is to solve not only the acute unemployment problem facing the nation, but also part of the rail troubles, for in the process, the railroads will move this season 100,000,000 tons of stone, gravel, sand, cement, asphalt, brick and other paving materials and will receive in freight revenue more than $100,000,000. It means placing in service approximately one-half of the 200,000 freight cars now idle and will go far toward relieving the conditions from which the roads are now suffering.

"Furthermore, money in plentiful quantities will be released for local circulation through wages to local labor and in payment to local producers of road materials, thus easing the pressure brought about by the reductions in price."

Resolutions adopted at the meeting are:

The Congress should be urged to pass the federal aid appropriations of $100,000,000.

That highway management be divorced from politics and all materials and methods entering into highways should be placed in competition.

That every highway be required to show traffic justification for its construction, thus guarding against extravagance and waste.

That Congress be memorialized to authorize the United States to join the Permanent International Association of Road Congresses made up of the highway departments of most nations.

That the Interstate Commerce Commission be urged to authorize a reduction in freight rates for road materials, thus stimulating a great road building program.

That public officials be urged to carry forward road building programs to the extent permitted by appropriations available, thus giving employment to the many thousands of men now out of work and utilizing tens of thousands of idle open-top freight cars.

PERSONAL MENTION

James J. O'Connor has been appointed superintendent of streets of Holyoke, Mass.

Henry Good has been appointed a member of the Montana State Highway Commission.

Malcolm Blue has been appointed road superintendent of Dunwich Township, Ont., Canada.

George W. Lanstrum has been appointed a member of the Montana State Highway Commission.

H. A. Templeton has been appointed a member of the Montana State Highway Commission.

L. M. Ross has been appointed county highway engineer of Mecklenberg County, North Carolina.

Robert C. Weller has been appointed general sales manager of the Lakewood Engineering Company.

D. H. Fleming has resigned as town engineer of Owen Sound, Ont., Canada, and is now city engineer of Niagara Falls, Ont.

H. G. Shirley has resigned as secretary of the Federal Highway Council to become road and sanitary engineer of Baltimore County, Maryland.

F. D. Doolittle has been appointed highway maintenance engineer of Whitman County, Washington.

C. R. Dart has resigned as bridge engineer for the Chicago Sanitary District to enter private practice

R. E. Palmer has been appointed assistant engineer with headquarters in Hornell by the New York State Highway Department.

Holton Cook has been appointed resident engineer by the Kentucky Department of State Roads and Highways, with headquarters at Dixon.

Julius R. Hall, Acting Engineer of Bridge Design, Chicago, Ill., has been appointed principal assistant engineer of the Chicago Sanitary District.

N. S. Sprague, formerly Chief Engineer of the Bureau of Engineering, Pittsburgh, Pa., has opened an office in that city as consulting engineer.

D. S. McCalman, State Highway Superintendent of Wyoming, has tendered his resignation, but many organizations of the state have asked him to reconsider his resignation. Delegations of business men and representatives of organizations in various parts of the state on April 5 met in Cheyenne to confer on the matter. It is understood that he may reconsider and remain, provided the proposed bond issue, to be voted upon May 10, is carried.

Bruce Aldrich has resigned as district engineer of the Asphalt Association, in charge of the Canadian district offices at Toronto, Ont., to become associated with Kilmer & Barber, Ltd., of Toronto. Before entering the employ of the Asphalt Association, Mr. Aldrich was in the Engineering Department of the District of Columbia. He has also been chief inspector of asphalts in the Municipal Laboratory of the City of Baltimore, Md.

Current Highway Legislation IV.

(Continued from page 218)

shall designate two intercounty roads for improvement. A tax of 0.3 mill is to be levied annually to maintain these roads. The cost of construction will be borne 25% by the state, 25 to 40% by county levies, 20 to 30% by townships and 10 to 20% by abutting property owners.

A bill has been introduced in the Legislature providing that all motor vehicle fees shall be used for the schools of the state.

A bill has been introduced which proposes to levy a tax of 1 ct. per gallon on gasoline sold in the state. The revenue would be divided equally between the state and the county in which collected.

(To be continued)

———ooo———

Middlesex County, New Jersey, has appropriated $265,000 to carry out the road repair program.

Mobile County, Alabama, will vote upon a $225,000 bond issue to be used in the construction of highways in the county.

Bloomfield, N. J. has abandoned its proposed paving program involving the expenditure of $500,000, because of opposition of taxpayers.

The City Council of Youngstown, O., has authorized a bond issue of $40,000 for the completion of the Ohio Avenue Bridge, which was started two years ago. The bonds must be sold before work can be resumed on the structure.

Several Hundred Feet of a Bridge in Cecil County, Maryland, have collapsed. The bridge crosses the Bohemia River and connects the first and second districts of the county. The structure has been in bad shape for some time, being closed several weeks last year for repairs, and the spring waters undermined the piling. Traffic is detoured 5 mi.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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*Illustrated article

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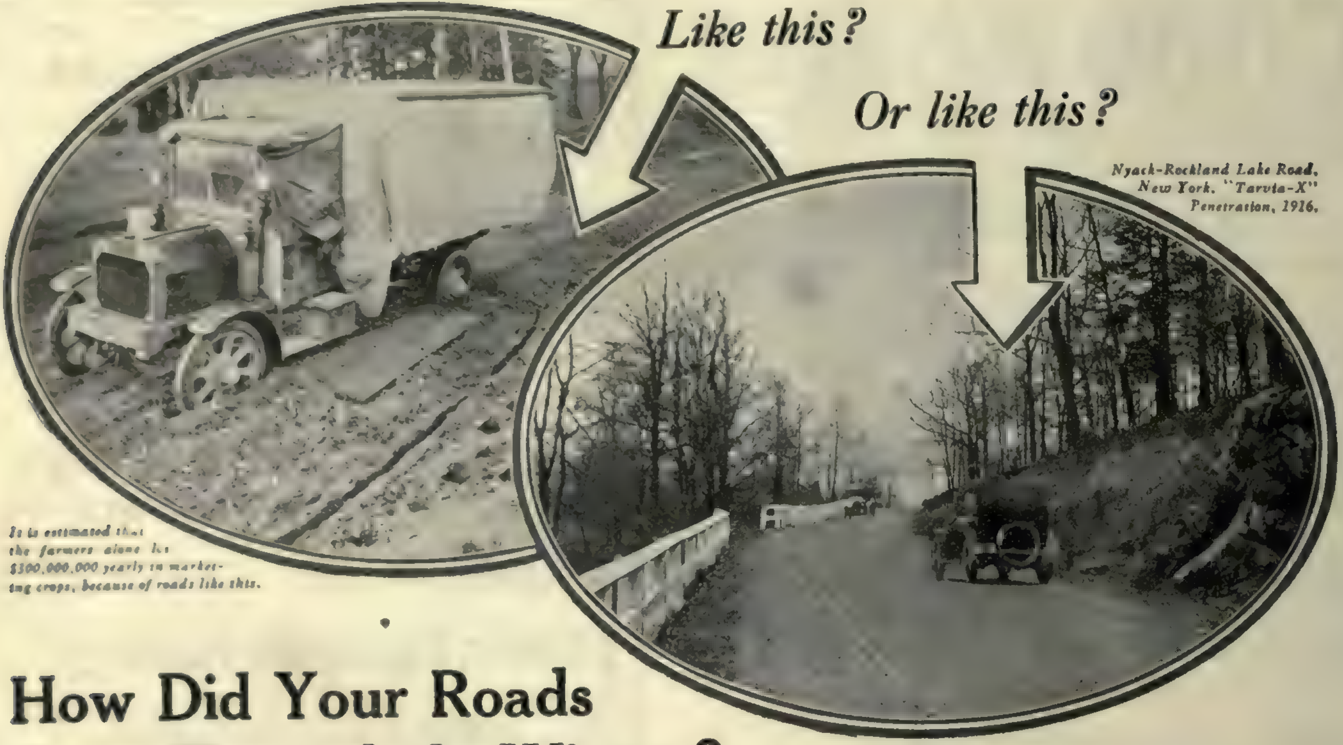

Nyack-Rockland Lake Road, New York. "Tarvia-X" Penetration, 1916.

It is estimated that the farmers alone lose $300,000,000 yearly in marketing crops, because of roads like this.

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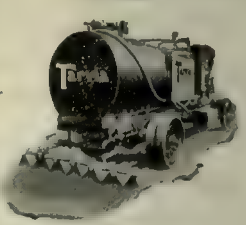

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Old Series, Vol. LX
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JAMESTOWN, N. Y., APRIL 27, 1921

Number
17

Earth Handling Machinery[*]

Scrapers, Excavators, Scarifiers, Plows, Steam Shovels, Drills and Spreaders and Finishers—Descriptions of Uses of Each Type

BY ALFRED H. SAUERBRUN [†]

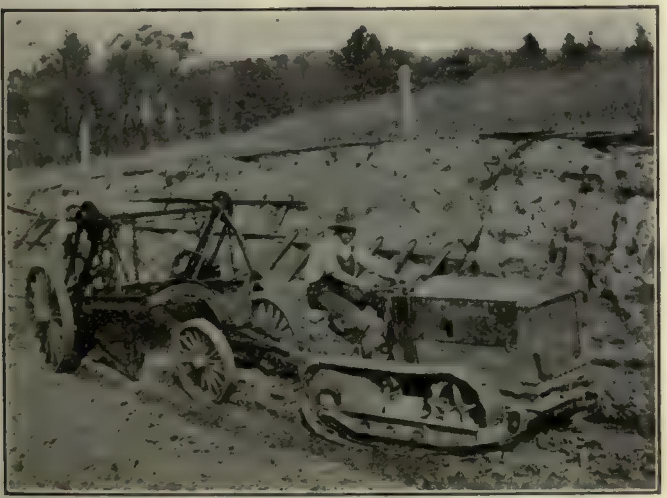
Since the building of the Pyramids, the cost of excavation has been of prime interest to the engineering profession.

Not so many years ago the cost of labor ran as low as $1.00 a day and a man with pick and shovel would excavate from 4 to 8 cu. yd. a day. Under those conditions, it was deemed advisable to use labor and not machinery. Times have changed, however. Today we pay labor $4.00 to $6.00 and consider ourselves quite fortunate if we can get a man to handle 3 or 4 cu. yd. of material. Therefore, it is essential that engineers interested in contract work consider the cost of handling earth work by all known methods, so that they will be in a position to recommend the most economical method for a given set of conditions.

Scrapers

There are four types of scrapers, the slip, the Fresno, the 2-wheeled scraper and the 4-wheeled scraper. The slip with two horses is good for 15 yd. per day with a maximum haul of 100 ft. It holds very little material, spills a great deal of it in transit to the embankment and leaves a very wavy subgrade.

The Fresno scraper is extensively used in the West for all sorts of excavation and is considered a very good tool. It spills very little in transit, and in sandy loose excavation it is possible to average 40 cu. yd., day in and day out, using a tractor. It is necessarily a short-haul scraper, say up to 400 ft. The large size, about 12 cu. ft. capacity, is preferable if used with tractor for handling and a snatch for loading. At the dump, the Fresno gives a very good spread, adjustments permitting depths of from 2 to 12 in.



Grading with Four-Wheeled Scraper and Tractor

Grading in Side-Hill With Steam Shovel

EARTH HANDLING MACHINERY IN OPERATION ON ROAD JOBS.

---

[*] Abstract of part of a paper entitled "Fundamental Principles of the Handling of Earth Work," presented at the 1921 Highway Engineering Conference of the University of Pennsylvania.

[†] Superintendent of Construction, Pennsylvania State Highway Department.

The 2-wheeled scraper, is good for 20 yd. per day with a maximum haul of 400 ft. It is machine hard on horses and men. The 12-ft. and 16-ft. machines require a snatch for loading. The drivers walk at all times, and you may figure that somebody is going to get tired. It is not as good a tool as the Fresno or Baker-Maney and it will not work well with a tractor.

The 4-wheeled scraper, Baker-Maney type, is a very good machine for long haul. It feeds automatically as the machine is drawn forward, and when it is filled to capacity, a clutch is thrown in and the bucket part is automatically raised off the ground, remaining in that position until the dump is reached. The rear door is then released and the material spread on the ground in a thin layer which requires hardly any hand shovel work. I prefer fitting this machine with a short pole and hauling with a tractor fitted with traction wheels. A snatch tractor of higher power is necessary, in addition to the hauling tractor, for loading purposes. A fair daily average is 50 cu. yd., with a maximum haul of 1,000 ft. Tractors for hauling are better fitted with traction wheels, because they make better time, and the snatch tractor for loading with Caterpillar traction on account of stronger draw-bar pull.

Scarifiers and Plows

With all of the scrapers described it is generally necessary to prepare the ground in advance by plowing, necessarily so when scrapers are used to excavate old macadam beds, etc. There are five ways of preparing the ground for scraping: (1) by teams with plow or rooter, (2) by tractor with plow or rooter, (3) by steam roller with detached scarifier, (4) by steam roller with pressure scarifier, and (5) by steam roller with large railroad plow or rooter.

Teams with plow or a tractor with plow or rooter should be used for fairly light materials and a steam roller with a pressure or detached scarifier or a steam roller with railroad plow or rooter for hard ground. Tractors will not do in hard ground on account of slipping. The detached scarifier is very cumbersome and hard to handle. Many of the old grading men prefer to use the steam roller on macadam, etc., together with the heavy rooter, and this rig is really the simplest and last word to date in breaking up the heaviest pavements.

Excavators

There are two kinds of excavators - the horse-drawn elevating grading and the power propelled elevating grader of the Koehring type. The former is not used in the East, but is used extensively in the West. It has great possiblities, especially in a flat, sandy country.

The Koehring excavator can be used in either hard or soft ground. The Keystone excavator, or semi-steam shovel, is a much cheaper machine than the ordinary steam shovel, but it will not do the work of a steam shovel.

Steam Shovels

Earth handling equipment is here considered in two classes - the scraper system and the excavators, to be applied to jobs of less than 3,000 cu. yd. to the mile; and the steam shovel to be used on jobs of over 3,000 cu. yd. to the mile. This division has been made with the thought that in selecting equipment, the different possibilities will be kept in mind. When all is said and done, the contractor usually prefers to use the steam shovel; it is unoubtedly the favorite digging tool of all the equipment in use. It is very fast and will handle all materials encountered with the exception of hard rock, which usually requires blasting. It will handle 600 yd. per day if that amount of material can be hauled away or disposed of by side casting. With this machine, haul is the problem.

There are two models of shovels — the 12 or 13- and the 18-ton machine. The 18-ton shovel is adapted to road construction, and I recommend that it be fitted with a ¾-yd. bucket with Panama or detachable teeth, a long dipper stick, a high lift boom and a boom hoist. The advantages of such special equipment are as follows:

(1) The dump wagons usually hold 1½ yd. of material, and two dippers full will fill a wagon. (2) The boom may be lowered quickly to pass under trolley wires, etc. (3) Trucks may be driven alongside on top of the bank and filled. (4) The material on the slope may be reached at a much higher level than it is possible to obtain by standard equipment, which is of great advantage.

The standard machines have traction wheels, but of late, some contractors are using shovels equipped with Caterpillars, claiming that they avoid the use of pontoons. There are three objections to Caterpillars. They are very slow travelers, and it is often necessary to travel 25 mi. or more from the unloading point to the job or from job to job. The wear and tear must be considerable on account of gathering up so much mud and sand, and they are much heavier than the ordinary 18-ton shovel with traction wheels, an item of no little importance when crossing county bridges.

The daily capacity of the shovel is limited only by the amount of material that can be disposed of by side-hill casting or hauling away. For short hauls, under 500 ft., teams with dump wagons are best. For longer hauls, say 1,000 ft., dump wagons with short poles and hauled by tractors are excellent. For longer hauls, automobile trucks are a necessary evil, but it is generally possible to effect a combination by which one or two motor trucks can be worked on the long haul, while teams or tractors

(Concluded on page 230)

Current Highway Legislation—V

Lawmakers in Various States Consider Measures Relating to the Organization of Highway Departments and Financing Road Work

(Continued from April 20)

Many of the state legislatures have ended their sessions for this year, after the consideration of numerous bills dealing with highway matters. In New York State approximately 100 highway and motor vehicle regulatory measures were introduced, of which about one-third passed both houses of the Legislature. The following report contains bills introduced in the various legislatures in addition to those previously reported in **Good Roads**, and summarizes the action on bills previously noted.

Arkansas

Governor McRae recently vetoed a bill to repeal the act of 1919 creating the Arkansas County Road District No. 5. The veto states that bonds amounting to $1,900,000 have been issued and to repeal the act now would result in practical repudiation.

California

Mr. Lee has introduced a bill providing for motor vehicle fees of 25 ct. per horse power and 50 ct. per 500 lb. gross weight for vehicles with pneumatic tires. Vehicles with solid or metal tires would be charged 75 ct. and $1.50 per 500 lb., respectively.

Delaware

The Senate has defeated a bill providing that all fines collected for violations of motor vehicle laws should be turned over to the State Highway Department.

The Senate has passed a bill creating a commission for the construction of a bridge over Murderkill River at Bowers Beach. An appropriation of $25,000 is provided.

The Senate defeated an amendment to the highway bill to appropriate $200,000 annually to take care of bonds, and then defeated the original bill.

Florida

A resolution has been passed by the House calling for an investigation of the State Road Department.

Louisiana

Louisiana wants to have a system of good roads but the legislators are somewhat divided as to the best way of securing them. In drawing up a new constitution for the state, two plans are before the constitutional convention. One, advocated by P. M. Milner, provides for a $27,000,000 bond issue running 26 years. The other plan, advocated by J. Y. Sanders, ex-governor, provides for a pay-as-you-go policy. By means of motor vehicle fees, the present road tax of ½ mill, a 2-ct. tax on gasoline and federal aid, it is expected that about $4,000,000 will be raised annually, which it is said will be sufficient to carry on highway work without the issuance of bonds.

Maine

A bill has been introduced in the Maine and New Hampshire Legislatures providing for the acquisition of the toll bridge between South Berwick, Me., and Dover, N. H.

Minnesota

Despite the passage of the bill providing for the construction of a state system of highways, it was referred back to committees of both houses. On April 9 it was amended by the House so as to limit the expenditure for hard surfacing to 20% of the construction fund with the proviso that the State Highway Commissioner may, in order to obtain federal aid, use an additional amount not to exceed 13 1-3%.

A bill has been introduced in the House to permit more than eight hours a day on state road work.

Nebraska

By an overwhelming vive-voca vote, the lower house on April 13 voted down a measure which would bar Nebraska convicts working on state roads.

New Jersey

Governor Edwards has signed a bill permittting the State Highway Commission to sell property in Bergen County originally acquired for a part of Route No. 10.

A measure was passed over the governor's veto by the Legislature, which places under control of the Public Utility Commission all motor buses which began operation since March 15.

A bill passed the Legislature and was approved by the governor appropriating $200,000 for the purchase of bridges over the Delaware River, connecting New Jersey with Pennsylvania.

The Senate failed to pass the bill providing for the submission to the people of a proposed $50,000,000 road bond issue.

Governor Edwards has signed a bill which requires bidders on county work to file certified checks of 10% of bids, not to exceed $20,000.

A bill permitting the State Highway Commission to pay its officers and employees by its own check has been signed by the governor.

One of the most important measures signed by the governor is House Bill No. 483, which increases motor vehicle fees 35%, both in regard to horsepower and weight.

A bill providing salaries of $4,000 each for the members of the State Highway Commission has passed both houses of the Legislature and been sent to the governor.

Both houses have passed a bill to continue the tax of one mill for roads and sent the measure to the governor.

Two bills to add approximately 500 mi. of highways to the state system were passed and sent to the governor.

A bill in the Assembly was defeated which provided for the reimbursement of contractors for war losses.

The Legislature passed a bill creating a state board to license professional engineers and surveyors.

The governor signed a bill providing payment of $125 to the owner of a frolicsome heifer which ventured to eat a stick of dynamite of the State Highway Department.

New York

Out of approximately 100 highway measures introduced in the New York Legislature, 26 were passed during the closing days of the session and are in the hands of the governor as 30-day bills. Previous to the closing of the session, the governor had signed ten bills.

Among the most important measures which failed to pass were the Lowman bill providing for a 50% increase in motor vehicle fees, which passed the Senate but failed to be reported out of the Rules Committee in the Assembly, and the Lusk bill, making it a misdemeanor to use state motor vehicles for other than official purposes.

Governor Miller has signed the bill appropriating $5,250 as the state's share of the cost of constructing rural post roads in conjunction with the Federal Government.

The Hewitt bill, appropriating $5,000,000 toward the construction of the New York-New Jersey vehicular tunnel, has been signed by the governor.

The McGinnies bill which appropriates $7,500,000 for maintenance and repair of state and county highways, was signed on April 11 by Governor Miller.

The following bills are in the hands of the governor as 30-day bills:

No. 1203, introduced in the Senate by Mr. Kirkland, provides that counties may aid towns in building and maintaining bridges over waterways intersecting county roads.

No. 1243, introduced in the Senate by Mr. Lowman, provides that town superintendents are to be removed by the commission rather than by the town board.

No. 1319, introduced in the Senate by Mr. Thayer, provides for the acquisition at state expense of toll bridges constituting connecting links between county highways.

No. 1136, introduced in the Senate by Mr. Ames, provides that advertising matter may be placed on highway signs, such advertising to be approved by the State Highway Commissioner.

No. 1146, introduced in the Senate by Mr. Lowman, provides that counties shall use motor fees for town highways as improved by county aid, and for county roads as improved by general or special laws.

No. 1506, introduced in the Senate by Mr. McWhinney, limits the amount which may be raised by a town in any year for the purchase of road machinery to $3,000, unless greater appropriation is duly authorized by a town meeting.

No. 1586, introduced in the Senate by Mr. Lusk, authorizes New York City to convey to the state its interest in lands and riparian rights for the construction of the New Jersey-New York vehicular tunnel.

No. 1661, introduced by Mr. Smith in the Senate, authorizes New York City to construct a tunnel between Richmond and Brooklyn under New York Bay.

No. 1710, introduced in the Assembly by Mr. Everett, authorizes the state highway commissioner to take rights of way and use sand, gravel and stone in forest preserves.

No. 170, introduced in the Assembly by Mr. Duke, makes a person who negligently operates a motor vehicle so as to injure a person, guilty of assult in the third degree.

No. 700, introduced in the Assembly by Mr. Jenks, limits the town board to $6,000 for repair or construction of bridges without a town meeting.

No. 1585, introduced in the Assembly by Mr. Mcginnies, appropriates $7,964,747 for payment by the state in the first instance of the Federal Government's share of the cost of improvement of rural post roads.

No. 1841, introduced in the Assembly by Mr. Lord, appropriates $107,583 for the construction of state highways, the money in the first instance having been Chenango County's share of cost of road construction.

No. 2058, introduced in the Senate by Mr. Lusk, makes losses sustained on contracts made prior to April 6, 1917, and proceeded with during the war, valid claims against the state or subdivisions.

No. 1939, introduced in the Assembly by Mr. Judson, transfers the administration of the Motor Vehicle Bureau from the office of the secretary of state to the State Tax Commission.

No. 1851, introduced in the Senate by Mr. Knight, places all street railways and motor bus lines in Greater New York City under the Transit Commission and those operating in the state outside of New

(Continued on page 231)

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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E. L. POWERS
Editor

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Managing Editor

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI APRIL 27, 1921 No. 17

ROAD AFFAIRS IN ARKANSAS

Because the makers of the laws of the State of Arkansas have failed to understand the first principles of state highway development, road laws have been enacted in that state which fail miserably in their application. Not only are the laws entirely unfitted to serve their purpose, but the highway officials, according to a statement by the U. S. Bureau of Public Roads, printed elsewhere in this issue, are indifferent to any competent advice to remedy matters. As a consequence, the road situation of Arkansas is in a chaotic condition and a storm of protest by overtaxed property owners has swept down upon the state.

Since it is the business of state highway officials to carry out the highway laws, why should not these officials attempt to shape workable highway legislation? The construction of highways of state importance with county funds or local assessments is illogical and unjust and state highway officials should refuse to operate under laws which require such discrimination. Why should the property owners of a poor section of Arkansas be required to construct a road for the traffic between much richer sections?

"The only hope of improvement is in a realization of the seriousness of the situation by the people of the state," concludes the statement of the Bureau of Public Roads, referred to above. After all, the people of Arkansas make their own laws and if they are unjust, the people must repeal them. A disturbance in the progress of highway development of Arkansas will not retard or hamper highway development in other states. Arkansas alone must lie in the bed she makes.

THE DIRECT SALE OF BONDS FOR PUBLIC WORK

In "Location, Grading and Drainage of Highways," by Wilson G. Harger, a textbook recently published, is a chapter on "Highway Bonds." It is a revision of a chapter from the "Highways Green Book," prepared by the National City Company of New York, N. Y., and is followed by two paragraphs which were prepared by Baker, Watts & Co., Baltimore bond dealers. One of these two paragraphs contains the following statement:

"Private sales of bonds for public works should be discouraged."

The reasons for this statement are not given, but a moment's consideration of the matter from a bond dealer's viewpoint should be illuminating.

In the past, the services of the bond house may have been necessary in the floating of all bond issues. The average citizen knew little about bonds—if he thought of them at all it was as some immensely costly and mysterious documents kept by the very wealthy in the seclusion of strong boxes and brought out occasionally to be shorn of coupons which in some way could be converted into cash. There was little market for bonds except among banks, institutions with invested funds and individuals of more or less wealth.

Thanks to the Liberty Bond campaigns by the Government during the war, all this is changed. Bonds are no longer things of mystery to ordinary people. Businesses requiring money have profited by the experience of the Government and have issued "baby" bonds and it is no longer necessary to save a thousand dollars in cash to become the possessor of a bond. Not only are bonds of small denominations available, but their purchase on the partial payment plan is as easy as the buying of a phonograph or a set of books on the installment plan. The result is that the United States has become a nation of bondholders.

That this changed attitude of the public can be taken advantage of in marketing public works bonds has been demonstrated more than once. And when it has been tried out it has generally resulted, we believe, in the saving of the public's money.

The middleman has always pleaded his indispensability and it is to be expected that the bond dealer should decry the direct sale of bonds for public work. But it is not clear why there should be permitted in a textbook the statement that "Private sales of bonds for public works should be discouraged," which means that states, counties and cities should buy their money only from bond dealers at bond dealers' prices.

Illinois Road Bids Lower

Bids submitted for grading and bridge work in ten counties of Illinois, show a decrease of 17% for grading and 11% for bridge work from the rejected bids of Feb. 18. The bids of Feb. 18 for grading aggregated $333,601 while the bids on the same work opened on April 13 aggregated $277,564, a reduction of $56,037. Bids for bridge work on Feb. 18 amounted to $288,368, while the bids of April 13 totaled $257,516, a reduction of $30,862.

Earth Handling Machinery

(Concluded from page 226)

are worked on the short haul fills. The industrial railroad has not been mentioned because embankments must be constructed in thin layers and each layer rolled and I do not see how this system could be used to advantage. It would require that the track be shifted after each train load in order that the roller could be used. If rolling could be eliminated, it would be possible to jack up the track, or in large fills, a dump trestle could be erected.

Drills

When rock is so hard that it cannot be loosened by the steam shovel, it becomes necessary to resort to drilling and blasting. Hand drilling need not be considered, on account of the present high cost of labor, unless the yardage to be handled is very small. We will assume the necessity of a drilling outfit.

The jack-hammer, operated by a portable gasoline engine and air compressor, is most efficient. We have in use on our work in Pennsylvania, an Ingersoll-Rand compressor with a capacity of 210 cu. ft. of free air per minute. We are using three jack hammers, Type DCR-13, and holes up to 14-ft. are drilled without any trouble. The outfit is readily portable and can be placed on a motor truck and moved to another job very easily. We find that the drills are excellent for side-hill work where set-ups would be quite difficult for tripod drills. Holes can be drilled parallel and on line with the slope, thus giving a good finished job without tearing down too much of the rock outside of the pay line. For shallow work, for side-hill work, and for thorough cuts up to 14-ft., we find that the jack hammer gives us excellent results.

In thorough cut work, I have noted the use of tripod or piston drills and well drills of the Keystone type. The tripod drill, while being very effective, is quite difficult to set up on side-hill work. There is much time lost hammering the bit when the drill sticks and in cleaning the holes, etc.

The well drill of the Keystone type, on account of the large charges of powder, very often shakes down material outside of the pay line. In a great many cases a path must be made for the drill carriage so that it can be moved along in a horizontal position. I believe that many contractors, when they become familiar with the possibilities of the jack hammer, will prefer this tool to all others.

Spreaders and Finishers

The Maywood scraper gives very good satisfaction in spreading on the dump. It is simply a steel-shod board, with tongue, and the board may be tilted at any angle. The small size road blade is also a good tool for this purpose.

No machine has yet been made that will do all the work necessary to prepare the final grade for placing the concrete mat; that is to say, there is no machine that will scarify, level the dirt off to final grade, roll the final grade and cast excess material over the side.

There is, however, a machine called the sub-grader which is only used when finishing the subgrade inside of concrete forms already set to grade. This machine works very well in sandy loam or loose material. Should the material be hard, it is necessary to scarify beforehand by means of the pressure scarifier on the roller. The sub-grader is hauled along by the steam roller, throwing the surplus dirt into windrows which may be readily cast off to the side.

The machines and equipment described in the foregoing are probably all of the types in use for roadway construction, at least in this section of the country. My choice of the equipment is as follows:

Of the scraper system, I prefer the use of the Fresno scraper drawn by tractor for short hauls and the Baker-Maney 4-wheeled scraper, drawn by tractor, for long hauls. For heavy work, I believe that the steam shovel will, without doubt, give the best satisfaction and I believe that you will agree with me that the steam shovel is really the only satisfactory tool to be considered for heavy work. It also does very well in shallow cuts where there is old macadam roadbed containing quantities of boulders and stone.

Middlesex County, New Jersey, Sells Bonds Above Par

Fourteen bids were received by Middlesex County New Jersey, on April 14 for $240,000 of road bonds and $48,000 of bridge bonds. The Perth Amboy(N. J.) Trust Company was the highest bidder on the road bonds, bidding $250,276.90 and the South Amboy Trust Company was highest bidder on the bridge bonds, bidding $50,407.

The Arkansas Road Situation

Official Statement of Bureau of Public Roads Says Arkansas Highway Officials Turn Deaf Ears to Outside Suggestions

Because the inhabitants of certain special road districts of Arkansas have protested against the excessive taxation for the construction of some roads, and because the daily press has directed considerable attention to the Arkansas road situation, the U. S. Bureau of Public Roads, after studying the matter, has issued a statement which follows, in part:

"Federal aid road projects in Arkansas are notably free from the serious conditions which are said to surround other highway construction in the state. The conditions complained of are to be found mainly in the road districts created by special local laws. The state law, known as the Alexander Law, though not perfect, provides sufficient safeguard to protect the public interest and to prevent confiscatory taxation. It provides that assessments levied shall not exceed 30% of the assessed valuation of the property.

"Under the Alexander Law the right of appeal from the assessments levied is protected. To establish a district the county court must have a petition signed by a majority in land value, acreage or number of landowners in the territory affected. The proposal must be advertised for three weeks and any property owner has a right to protest at any time within 30 days.

"In certain special districts, on the contrary, it is alleged that the limit on assessments is raised to a practically confiscatory level, that unjust discriminations are made in the law and that, on account of special provisions, assessments are not always in proportion to benefits. These districts are created by acts of the Legislature and not upon the petition of the landowners and opportunity for appeal is usually denied. The time allowed for appeal against the assessments is usually reduced to two or three weeks. Though a number of federal aid projects are in such districts, the Bureau of Public Roads has not been advised of any injustice in connection with federal aid projects.

"The principal difficulties which the Federal Government has encountered in its work in Arkansas have arisen from causes altogether aside from the acts creating the districts. They are due mainly to the peculiar conception of the Federal Aid Road Act held by officials of the State Highway Department, which has led them to act as though the only function of the Bureau of Public Roads was to approve any project which the state might submit. It has been necessary on a number of occasions to deny the correctness of this interpretation.

"Further trouble has been caused by the ill-advised promises of federal assistance made by persons connected or associated with the state department. These promises have been made without definite knowledge as to whether there would be money enough to fulfill them, or whether the details of the projects submitted would be satisfactory to the Federal Government. The failure to comply fully with these promises has developed considerable local dissatisfaction and a feeling on the part of those unfamilar with the facts and with the limitations imposed by the Federal Aid Road Act that the Federal Government was in some way to blame.

"The Bureau of Public Roads has made several efforts to assist the state in the correction of the laws and the conditions which are complained of, but has met with no great success on account of local resistance. The only hope of improvement is in a realization of the seriousness of the situation by the people of the state."

Current Highway Legislation—V

(Continued from page 228)

York City under supervision of the Public Service Commission.

Pennsylvania

A bill has been introduced in the Senate which appropriates $250,000 to reimburse railroads for credits extended road contractors last year. When the increased freight rates went into effect, the State Highway Department agreed to absorb the increases and arranged with the railroads to extend credits.

On April 6 the House passed a bill providing a tax of 1 ct. per gallon on gasoline.

(To be continued)

Racine County, Wisconsin, Will Build Own Roads

Because bids received for the construction of concrete roads were consdered too high, Racine County, Wisconsin, will build its own roads. The county owns two gravel pits, has purchased some road machinery and has contracted for cement. Several contracts were let, but when bids rose to an average of about $35,000 per mile, it was decided not to let any contracts.

To Bridge Newark Bay

Plans for the construction of a bridge over Newark Bay from Bayonne to Newark, N. J., were approved on April 15 by the Newark Bridge Commission. Plans will now be submitted to the War Department. The bridge will form a part of the state highway connecting Trenton with New York City via the proposed Hudson River vehicular tunnel. The tentative figures submitted place the cost of the structure at approximately $3,000,000. The state will bear one-half of the cost and Essex and Hudson Counties the remainder.

New Hampshire Good Roads Association

OFFICERS FOR 1921

HARRY L. SMITH, President	Lakeport
JERRY KILLORY, Secretary and Treasurer	Laconia
C. M. BROOKS, First Vice President	Keene
OZMAN W. FERNALD, Second Vice President	Berlin

Board of Directors

OVID F. WINSLOW	Nashua
F. H. COLBURN	Concord

During March the state highways of New Hampshire suffered so much damage from heavy trucks that Commissioner Everett recommended legislation to limit the weight of load during the critical period and as a result House Bill No. 255 was passed without delay. The bill reads as follows:

Section 1: To amend Chapter 96 of the laws of 1917, by by adding to section 4, a new section.

Section 5: Authority is hereby given the state highways commissioner to make such rules and regulations, subject to the approval of the Governor and his council, as may be necessary to insure the proper use and to prevent abuse of the state aid and trunk line highways during certain seasons of the year. Such rules and regulations shall be filed with the selectmen of the towns affected by the same, who shall cause the same to be posted. Such rules and regulations shall be inserted in one or more state papers, one or more times.

Any person violating such rules and regulations and thereby causing damage to the highway, shall be fined not exceeding $100 for each offense and shall be liable for all damage done thereby.

As soon as the law went into effect Commissioner Everett issued the following rules and regulations to take effect March 21:

All vehicles of over three tons gross weight are prohibited the use of the trunk lines, cross state and state aid highways of this state from 7 a. m., March 21, until further notice.

Selectmen of towns will see that suitable notices are placed in conspicuous places so that the public may be immediately informed of the order.

Notice shall also be given police constables and all other administrators of the law, with instructions to enforce the provisions of this act.

The purpose of the order is to protect highways of the state during the frost season and it will be withdrawn as soon as conditions permit.

Before preventive measures were enforced serious damage was done to many highways, notably in Hooksett, where several heavy lumber trucks have been operating all winter. Other highways, in Merrimack, Wilton and Exeter, were damaged.

When the restrictions were placed on heavy trucks the manufacturers and trucking contractors protested but the regulations remained in force until in the opinion of Mr. Everett the roads were fit to carry the heavy vehicles.

On April 13, the House passed the appropriations bill and also the bill levying a state tax for 1921 and 1922. The 1921 state tax will be $1,700,000 and for 1922, $1,500,000.

Among the items the appropriations bill provides are the following: Public Service Commission, $21,400; Forestry Department, $68,300; Highway Department, $325,000; interest charges, $87,926; maturing bonds, $85,000.

The commissioner of motor vehicles is authorized not to exceed the sum of $125,000 per year. The governor and council have authorized the motor department not to exceed that amount.

This covers the fiscal year ending June, 1922, or one-half the appropriations for the two-year term.

At the session of the Legislature just closed, a new motor vehicle bill has been passed greatly increasing the license fees for trucks and making some increase on all motor vehicles so that the increased revenue from this source for the year 1922, the net income of which is used for the maintenance of highways, will amount to nearly $400,000.

Commissioner Everett also reports that the Legislature provided an appropriation for reconstruction and maintenance for the present year of $200,000. This, together with the motor vehicle fees, will give a substantial amount to put the roads in condition for the season and keep them so.

Provision has been made for assisting the towns in the construction of new bridges and an appropriation of $30,000 for each of the next two years was made for this purpose.

The department is expecting to do very little new construction the coming year, outside of cleaning up the federal aid projects that were begun last year and about ten projects which were surveyed last year and the work carried over because of the high cost of labor and materials.

The proposed naming of one of the great highways of New Hampshire for Daniel Webster is heartily endorsed by Senator Henry Cabot Lodge of Massachusetts member of the committee on foreign relations, in a letter to Judge Edgar Aldrich of Concord under date of Feb. 7, made public recently.

The celebrated Massachusetts statesman has written considerable on Webster, including his biography, and delivered the address at Washington on the unveiling of the statue of the great Granite State orator. His letter to Judge Aldrich follows:

"I have your letter and the enclosures, which I have read with a great deal of interest, and am very much obliged to you for writing to me. I am extremely glad to hear that you are to name one of the great highways of New Hampshire for Daniel

Webster. It is an honor of a most fitting kind and I am very glad you are going to call it a highway or a road and not a boulevard.

"I am glad you found anything in my Plymouth speech which you could use. I have written a great deal about Webster, first and last, not only his biography in the Statesmen Series but one or two articles, and I delivered the address here on the unveiling of the statue where I discussed him simply from the point of view of the orator. In case you have not had that I am going to take the liberty of sending it to you."

New York State Road Builders' Association

OFFICERS

JOHN H. GORDON, President,	Albany
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M. F. DUGGAN, Secretary	Albany

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W. T. THAYER	Chateaugay
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FRED E. ELLIS	Melrose, Mass.
W. A. GREENFIELD	Hornell
C. J. HENDRICKSON	Syracuse
J. F. PADDELFORD	Sherburne

Crusher Run

The annual election of the New York State Road Builders' Association was held at the rooms of the Association, on Friday, March 18. The following officers were elected for the year 1921: President, to serve one year, John H. Gordon, Albany; Vice President, to serve one year, C. J. Hendrickson, Syracuse; Trustees, to serve three years, Louis Mayersohn, Albany, N. Y. and Wm. G. Fox, Saratoga Springs, N. Y. This election of Mr. Gordon marks his seventh year as president of the association.

On the same day, at 3:00 p. m., there was a meeting of the members and associate members of the association. The question of wages for unskilled labor was freely discussed. The meeting was very largely attended.

Commissioner Sisson has made arrangaments with Charles F. Ratigan, State Superindent of Prisons, whereby convicts from Auburn, Clinton and Comstock prisons will be used to construct state highways this year.

The first letting of road contracts since Herbert S. Sisson became state highway commissioner was held on Friday, March 18. The bidding was the most spirited since before the war. There were 118 bidders on 21 contracts, and on 3 contracts there were 42 bidders. The contracts awarded amounted to $2,917,065.15. The letting was attended by more than 300 contractors from all parts of the state, and they assured Commissioner Sisson that this year will be a very busy one on highway work as labor and material are fast nearing a normal state, as evidenced by the activity in bidding.

The McGinnies Bill, appropriating $5,000,000 for the maintenance and repair of state and county highways has been signed by Governor Miller.

Theron M. Ripley, who was reinstated as division engineer, by Commissioner Sisson, will receive his salary for the time he lost pending a decision, one year and a day. The salary will amount to $5.194.44.

On Tuesday, May 3, there will be 49.14 mi. of highway let for improvement, and on the same day 7 repair contracts are advertised. Six of them will be bituminous macadam jobs and one will be of reinforced concrete. The next day, Wednesday, May 4, there will be let 49.23 mi. and 7 repair contracts, 4 bituminous macadam, and 3 of reinforced concrete.

The Board of Supervisors of Amsterdam, Montgomery County, have approved plans for the Manny's Corners-Blue Corners state highway as prepared by the Highway Department. The plans call for the construction of a macadam road at a cost to the county of $65,303. A deadlock has existed for several months because the residents objected to a concrete roadway.

Commissioner Sisson and former Commissioners of Highways C. Gordon Reel and Captain Frederick Stuart Greene, John H. Gordon, President of the New York State road Builders' Association, Richard Hopkins of Troy, N. Y., and Jos. J. Malloy, Schenectady, N. Y., were among the delegates appointed by Governor Miller to represent New York State at the ninth anual convention of the United States Good Roads Association at Greensboro, N. C., April 18 to 23.

At the letting which took place on April 5, 1921, the following members of the New York State Road Builders' Association were low bidders and were awarded contracts:

John H. Gordon, Onondaga County, Scott-Borodino, Pt. 2, $118,788.90; Louis Mayersohn, Herkimer County, West Exeter-West Winfield, Pt. 2, $51,004.60; Louis Mayersohn, Warren County, North Creek-North River, $192,129; J. F. Paddelford, Chenango County, Sherburne-Columbus, $278,035.80; S. B. Van Wagenen, Inc., Washington County, Whitehall-Fairhaven, $371,898.50.

Commissioner Sisson has decided to abolish the gang system which was tried out last year, and replace the road repair gangs by a modified patrol system. Several hundred patrolmen will be appointed for duty in the 57 counties. After the winter the country roads are said to be in very bad condition. The patrolmen will cover fixed stretches of highway and will work independently. Second Deputy H. G. Hotchkiss, Jr. will be in charge of the maintenance work. It is expected that $7,500,000 will be required to complete necessary repairs.

Massachusetts Highway Association

OFFICERS FOR 1921

HENRY V. MACKSEY, President	Framingham
JOHN M. McCARTHY, Secretary	Natick
CHARLES A. BROWN, Treasurer	Wellesley

VICE PRESIDENTS

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HENRY A. SPATES	Gloucester
WILLIAM P. HAMMERSLEY,	Norwood
FRED B. RICHARDSON	Brookline

Announcement

This section of the paper is open to members of the Massachusetts Highway Association for the discussion of matters directly connected with road interests. Members are requested to submit items of interest for use in this column.

Address all communications to GOOD ROADS, P. O. Box 2705, Boston

The New England Road Builders is now in a flourishing condition and will consider applications for membership from any road men who are qualified to join.

"Represented" members are those (firms or corporations) who "employ labor in the road building industry."

"Associate" members may be individuals, firms or corporations "not employing labor in the road building industry, but engaged in any industry affiliated with the road building industry."

As will be seen by the descriptions of members the organization is composed principally of road contracting firms and the association should be of great assistance in promoting pleasant relations between the various highway departments and the men who do the work on the roads.

Bulletins giving details of contracts awarded and to be let and also much other detailed information are distributed to members regularly and any one interested may obtain application blanks, etc., by addressing the secretary of the association at 68 Devonshire St., Boston, Mass.

The following schedules summarize the receipts and expenditures of the Massachusetts Board of Public Works, Division of Highways, during 1920.

RECEIPTS

Receipts from registration of automobiles in 1920 (including operators' licenses and fines)	$4,006,684.74

EXPENDITURES

Expenditures for maintenance and improvement on roads in 1920	2,710,233.90
Balance	$1,296,450.84

TOTAL EXPENDITURES DURING 1920:

Commissioners, clerks and assistants	$ 29,119 27
Engineers, etc.	40,215.46
Travel	3,298.97
Incidentals	12,124.90
Care of road building machinery	333.441.58
Gypsy moths	13,000.00
Maintenance and improvements	2,710,233.90
Fall River, Somerset and Newburyport bridges	16,025.79
Registration, personal services	249,375.83
Other expenses	177,444.05
Construction of highways	1,251,919.00
Snow removal	18,923.00
Special improvements	6,737.83
Improvements, Prospect Street, Leominster	4,695.16
Hingham Highway Loan	4,854.52
Western Massachusetts Highway Loan	211,343.77
Other Special improvements	92,226.95
	$5,185,079.98

It is to be noted that these expenditures are the complete expenditures of the commission, including the Western Massachusetts Highway Loan of $211,343.77. The cost of maintenance, improvement and construction of highways alone amounted to $3,962,152.90. This, substracted from the receipts of $4,006,684.74, shows that after paying the total cost of maintenance, improvement and construction, there was still a balance left of $44,531.84.

The cost of consrtuction, given us from an authoritative source, have been reduced substantially as follows:

Item	Highest Price 1920	Price today
Crushed stone	$ 2.00 per ton	$ 1.75 per ton
Sand	2.00 per ton	1.75 per ton
Cement	4.87 to 7.00 per barrel	3.87 per barrel
Lumber	75.00 per 1000 ft.	50.00 per 1000 ft.
Labor	.60 to .67½ per hr.	.45 to .50 per hr.

To put it in another way, the receipts from registration fees of 1920 over 1919 are almost 47½%, while the costs of materials and labor have decreased as follows:

Crushed Stone	12½ %
Sand	12½ %
Cement	20 % -45 %
Lumber	33⅓ %
Labor	25 %

(Concluded on page 236)

MEETINGS

Calendar of Coming Meetings

April 29—National Highway Traffic Association— Annual Convention, Detroit Athletic Club, Detroit, Mich. Secretary, Elmer Thompson, 247 W. 54th St., New York, N. Y.

May 9-11—American Association of Engineers.— Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12.—Canadian Good Roads Association.— Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

June 21-24.—American Society for Testing Materials.—Twenty-fourth annual convention, Asbury Park, N. J. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Canadian Good Roads Association

The annual convention of the Canadian Good Roads Association will be held at Halifax on May 10, 11, 12 and 13. On the morning of the first day Dr. E. M. Desaulniers, President of the association, will open the convention. The opening will be followed by addresses of welcome by McCallum Grant, Lieut. Governor of Nova Scotia, and other public men, to which S. L. Squire, Chairman of the Executive Committee, will respond. In the afternoon of the first day the following papers will be given: "Federal Aid," by P. J. Veniot, Minister of Highways, Province of New Brunswick; "The Success of Federal Aid in the United States," by Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads; "Gravel Roads," by B. M. Hill, Provincial Highway Engineer, New Brunswick; "How to Improve and Maintain Earth, Clay and Sand Roads," by Paul D. Sargent, Chief Highway Engineer of Maine; "Bituminous Treatment of Gravel and Sand Roads", by Col. W. D. Sohier, former chairman of the Massachusetts Highway Commission.

On the second day the following papers will be given: "The Road Situation in Britian's Oldest Colony," by S. A. Churchill, Deputy Chairman, Newfoundland Road Commission; "Economical Methods of Rebuilding Gravel and Macadam Roads," by E. A. James, Chief Engineer, York County Highway Commission;"Right of Way and Roadbed Widths," by W. A. McLean, Deputy Minister of Highways of Ontario; "Financing, Bonding and Revenue for Highway Construction," by William Findlay, Business Manager, "The Globe," Toronto, Ont.; "The Necessary Organization for the Efficient Administration of Highways Department," by A. E. Foreman, Portland Cement Association; "Progress in Road Building on the Island Province of Prince Edward Island," by C. W. Crosby, Minister of Public Works, Prince Edward Island; "Transportation; Its Difficulties and Some of Its Possible Solutions," by C. G. Spencer, Goodyear Tire & Rubber Co. of Canada; "How to Preserve a Macadam Road," by A. P. Sandles, Secretary, National Crushed Stone Association, Columbus, O.

On the third day, May 12, the following papers will be given: "Asphaltic Concrete Pavement," by S. J. Latta, Minister of Highways of Saskatchewan; "Highway Bridges and Culverts," by A. McGillivray, Chairman, Good Roads Board, Manitoba; "The Road Contractor," by Col. W. G. MacKendrick, D. S. O.; "Refined Tar in Contruction and Maintenance," by P. P. Sharples, The Barrett Co., New York, N. Y.; "Maintenance," by J. A. Duchastel; City Manager, Outremont, P. Q.

On the last day a motor trip will be made through the Land of Evangeline. A special train will go from Halifax to Kentville and a motor trip will be made through Gaspereaux Valley to Grand Pre, from whence the members will return by train to Halifax.

Nebraska Road Institute

The fourth annual meeting of the Nebraska Road Institute was held on April 21 and 22 at the College of Engineering of the University of Nebraska.

The first day was devoted to inspection trips of the roads of Lancaster County. On the second day the following papers were presented: "County Highway Patrol Maintenance," by D. L. Erickson, Deputy County Engineer, Lancaster County; "Maintenance of Nebraska Highway System," by A. S. Mirick, Division Engineer, Nebraska Department of Public Works; "Federal Aid and Maintenance," by J. C. Wonders, District Engineer, U. S. Bureau of Public Roads; "Auto Tourist Camps," by Charles H. Roper, President, Denver, Lincoln and Detroit Highway Association; "Seeing Nebraska by Areoplane," by Dr. Geo. E. Condra, Director, Nebraska Conservation and Soil Survey Commission; "Maintenance and Construction of Gravel Roads," by F. R. White, Chief Engineer, Iowa State Highway Department; "Highway Program for 1921," by Geo. E. Johnson, Secretary, Nebraska Department of Public Works.

PERSONAL MENTION

A. J. Rhodes has been appointed city engineer of Manhattan, Kan.

William C. Tuttle has been appointed superintendent of highways of Attleboro, Mass.

Charles M. Reppert has been appointed chief engineer of the Bureau of Engineering of Pittsburgh, Pa.

John Chambers has resigned as city engineer of Louisville, Ky., to become chief engineer of the Louisville Water Co.

H. J. Sams, formerly County Engineer of Napa County, California, is now field engineer of the Portland Cement Association.

———ooo———

Massachusetts Highway Association Notes

(Concluded from page 234)

The Boston Finance Commission has sent to the Legislative committee on social welfare, at the State House, a report of the commission's study of the need of a general pension system for employees of the City of Boston and county of Suffolk, with a bill which, if enacted, would provide Boston with a general pension system for all its city and county employees, except school teachers.

No Massachusetts city has a pension system for all city employees. The only Boston employees who are now excluded from pensions, outside of the professional class, are the clerical, engineering, investigative and inspection forces, totaling about 6,345.

The recent opening of bids in the City of Springfield shows an encouraging tendency toward lower prices for building and road supplies.

The Fleming Foundry Co. of Springfield, was well below its nearest competitor on the contract for manhole and wellhole castings. This firm's bid was 2.5 ct. a pound, while the Springfield Foundry Co., the nearest competitor, bid 3 ct. a pound. The Sessions Foundry Co., which got last year's contract, bid 4.31 ct. a pound. There were eight bids on the vitrified clay pipe contract, four Springfield firms submitting proposals, with the Cook Builders Supply Co. apparently low, in view of special discounts offered.

On Portland cement the Cook Company also seemed to be the low bidder, its figure, however, not including the freight charges against the city which will necessitate figuring out that additional cost. Whereas last year's price on Portland cement was in all instances nearly $4 per barrel, this year's bids are nearer $3 a barrel with a 10 ct. allowance for each bag returned in good condition. The Cook Company's bid was $2.535 on one brand and $2.59 a barrel on another brand, freight charges not included.

The other bidders were the H. C. Puffer Co., of Springfield, $3.07, including freight charges: T. Shea, Inc., $3.20; Edward S. Roach of Providence, $3.28; and Springfield Contractors' Supply Co.

The John S. Lane Co. of Meriden, Conn., was the only bidder on trap rock, with prices well below last year's bid.

On surface asphalt the Standard Oil Co., with bids of 7.75 ct. for light asphalt and 8.08 ct. for heavy, and the Warner-Quinlan Co., with 7.95 ct. for heavy and 7.7 ct. for light oil, look like the choice on this contract.

On granite curbing the Pease Company of Nashua, N. H., seems to have the edge on competitors, although on some of the curbing types Lewis P. Palmer & Sons of Granville, were lower. For circular curbing of all radii the Pease Company's bid was $1.20 a foot. Duncan Rusk, last year's successful bidder, went as high as $1.70 a foot on 6-in. circular curbing of from 3-ft. to 5 ft. radius.

The Pease Company also seem to be the likely contender for the granite block contract with a bid of $104 per thousand, or $3.10 per square yard. The Hildreth Granite Co. of Boston bid $3.13 per square yard. The only other bidder on these blocks quoted a price of $120 a thousand. The curb and granite block bids were also lower than last year's.

Wm. C. Robinson & Sons Co. of New York offered the lowest price on non-asphaltic oil, 7 ct. per gallon Mace Moulton, Jr., of Boston was the nearest competitor on this contract, with a price of 7.2 ct. a gallon.

On the 45% asphalt road oil the Alden Speare Co. of Boston was low, with a price of 6.29 ct. a gallon. The Standard Oil Co. of New York was next with a bid of 6.9 ct. a gallon. Fourteen bids were submitted on these two contracts, and the bidders were bunched together closely for the most part.

The Standard Oil Co. was just a trifle lower than the nearest competitor on penetration asphalt, with a bid of 8.08 ct. a gallon, the Warner-Quinlan Co. offer being 8.7 ct. a gallon. Carrying out their bids to four decimal places indicates close figuring on the part of the oil firms. Seven bids were received for this contract.

The American Tar Co. of Boston was a cent below the Barrett Company of Boston, the only other bidder for road tar. The bid was 11 ct. a gallon.

Five bids were received for asphaltic cement with the Texas Co. of Boston well under the nearest rival. The Texas bid was $20.45 a ton. Mace Moulton, Jr., made a hard try for this contract with a bid of $21.60 in tank cars. The highest bid was by the Atlantic Refining Co., its price being $23.18 a ton.

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Fewer Men, More Work, Better Roads

By JOHN STANLEY CRANDELL*

Many contractors have not, even at this late day, grasped the fact that they may reduce costs in road construction, as in other lines of construction, by the elimination of man power. The war was supposed to open the eyes of the world to what can be accomplished by machinery, and maybe it did—in Europe. But there are many here in this country who are blind, or will not see.

There is but one kind of highway construction that has been attacked with anything like the right attitude and that is concrete road work. There has been considerable improvement in methods of handling materials on the job, but there is still room for further effort. But in such a simple matter as the spreading of the cover over a bituminous treated road there has been almost no attempt to improve over hand spreading. As a result costs are up.

There are thousands of mi. of road to be built soon, and it behooves every contractor and engineer to cut his costs to the lowest possible figure in order to get the work done for the least money. In the matter of concrete road construction there has been developed the use of industrial railways to carry the bulky road material. Other types of construction require the movement of just as bulky material and almost as much of it. But I do not remember seeing any account of any macadam, tar macadam, asphaltic concrete, or other type of road being built with the use of an industrial railway. Yet there is much justification in using a light railway for such work.

And yet the use of a light railway is not indicated in some parts of the country. For instance, there is not a place in New England where it would be advantageous to use such a railway. In that section of the country, it is possible nearly always to transport the materials of construction on trucks, at the least cost. Roads are in good condition there most of the year, and hauling by truck would be much more economical than the installation and operation of a light railway. But in the Middle West and in the South, the light railway would be the greatest

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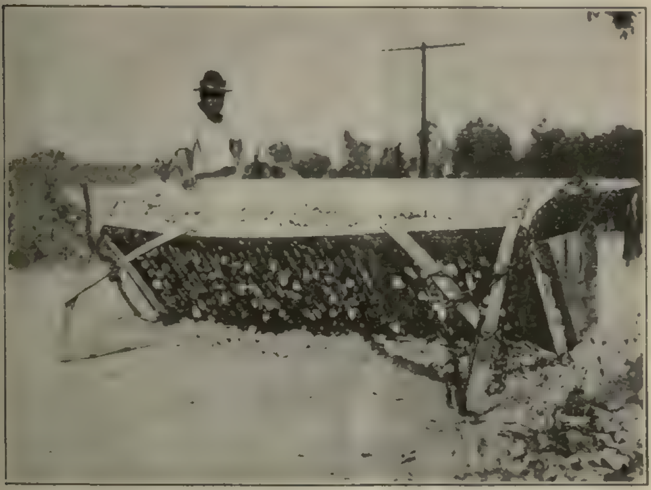
*Consulting Engineer, General Tarvia Department, The Barrett Company.



BANGERT STONE SPREADER ON HALLS FERRY ROAD, ST. LOUIS COUNTY, MISSOURI

SPREADING GRAVEL AND ROLLING WEARING COURSE, ST. LOUIS COUNTY, MISSOURI aid to the contractor who has a fair sized contract.

For resurfacing jobs the light railway would not be economical. But where the road has to be built from the bottom up, as is the case in so many of the states, it certainly is worth while trying. I recall a road being built in Mississippi last year where conditions were ideal for an industrial railway. Here a gravel road 8 mi. long was being built. The gravel was brought as near the job as possible in railroad cars, and then transported in wagons, drawn by mules as far as 10 mi. away. It often took four hours for a team to make a one-way trip, and when there had been a rain, work was stopped for several days until the old dirt road had dried out sufficiently to permit hauling. A light railway would have saved thousands of dollars and weeks of time.

There are many engineers and contractors in the East who do not realize the problems that their brethren who dwell in less favored parts of the country have to contend with. It is not until some contractor bites off a job that is different from what he has been accustomed to that he begins to chew it over. Then instead of adapting his methods to the job, he tries to adapt the job to his old methods, and he wonders why he loses money.

The matter of spreading chips, gravel or sand as a cover for bituminous treatments seems simple enough, and yet there is no really good spreader on the market. There is no reason why there should not be, but the fact remains that there isn't. This is probably due to no one's having put his mind to the subject. The enormous yardage covered yearly should be an incentive to any one with an inventive turn of mind, and the rewards should be ample to induce inventors to bestir themselves.

A job illustrative of what may be done by a few men and several good machines is the Halls Ferry Road, St. Louis County, Missouri. Four men built 3 mi. of tar penetration pavement in 90 days. The equipment used consisted of two gasoline rollers, a stone loader, motor truck equipped with a stone spreader and a gravel spreader, a few rakes, shovels and wheelbarrows. These last were not used much, as the gasoline-driven equipment did 95% of the work. The ideas for the labor saving devices originated in the head of the contractor, who was also foreman and general handy man about the job. Everything was of the simplest design, but strongly built. Also, everything worked. The tar was supplied in and applied from a motor truck by a local tar manufacturer, so that that part of the work was entirely out of the contractor's hands. The stone spreader distributed the stone so evenly that only a little raking was necessary to smooth up the surface before the tar was applied. Then the chip spreader backed on the road and distributed enough chips to fill the voids, and after the seal coat of tar was applied the chip spreader again backed on, and spread the cover.

There is one weakness in all spreaders: Those that successfully spread, back onto the treated surface; otherwise the wheels that precede the spreading will pick up the bitumen and spoil some of the road surface. The successful spreader should drive forward over the road, spreading chips or cover BEFORE it. To date there is none that will do this.

There is much machinery on the market that could readily be adapted to road building work, but contractors seem to be loath to try anything new until someone else has tried it.

Toll Bridge a Gold Mine

The report of the Harve de Grace and Perryville Bridge Company, of Maryland, for 1920 shows that the gross income for the company for last year was $116,892. Dividends amounting to $40,000 were paid, $21,372 carried to a depreciation fund, $5,000 put away as a special reserve and a total reserve of $44,568 carried over. This bridge was given away by the Pennsylvania Railroad to a small group of men about ten years ago. These men made a capital investment of but $700. The bridge now pays dividends of 8% on a capitalization of $500,000. The structure was originally offered to Cecil and Hartford Counties, but these counties refused to take it. The history of the toll bridge reads like a fairy tale in high finance. The bridge company originally incorporated at $50,000, but only $700 was paid in. In 1915, after paying dividends each year, a 40% dividend was paid by the company. In 1916 a 900% stock dividend was declared.

The present tolls levied on this profitable bridge are $1.50 for a 2-ton truck, $2 for a 3-ton and 4-ton trucks and $2.50 for 5-ton trucks. For all trucks carrying over five tons, 50 ct. per additional hundred pounds is charged, with a minimum toll of $3.50. Foot passengers pay 5 ct. each and passenger cars, 10 to 60 ct.

Taxpayers of Pulaski County, Arkansas Protest Increased Assessments

The Pulaski County, Arkansas, Taxpayers' Protective League on April 14 drew up a resolution protesting against a proposed reassessment to finance a $2,500,000 bond issue for completing the Little Rock-Hot Springs Highway. The league went on record as opposing any reassessment to finance more than a $600,000 bond issue and repeated the stand of the league favoring the completion of the highway from the Saline County line to Hot Springs with a gravel surface.

Iredell County, North Carolina, has sold $300,000 of road bonds to A. B. Leach & Co., of New York City at par and accrued interest.

Current Highway Legislation-VI.

Highway Officials Association Have Important Measure Introduced in Congress—Three States Pass Gasoline Tax and Two Raise Motor Fees

(Continued from April 27)

Among the tendencies of highway legislation this year are the raising of motor vehicle fees and the placing of a tax on gasoline. Motorists have been very active in opposing such legislation; in New York the proposed increase in motor vehicle fees was defeated and in California the proposed tax on gasoline was defeated. Up to the present time four states have gasoline taxes, Colorado, Florida New Mexico and Oregon. Whether or not it is equitable to motor vehicle owners to place a tax on gasoline, it is of interest to know that England recently increased her tax on gasoline and is now obtaining from that source over $40,000,000 per year.

United States

A number of bills have been introduced in the U. S. Congress, most of which follow the plan of the bills introduced by Representative MacArthur and Senator Townsend last year. The new MacArthur bill which has been introduced calls for the appropriation of $75,000,000 a year for four years, preference being given to the construction of such roads as will expedite the complete of an adequate national highway system connecting at state boundaries.

Senator Stanfield of Oregon has introduced a bill providing for the creation of a seperate fund from federal sales taxes on products of the motor vehicle industry for highway construction and maintenance. During the fiscal year ending June 30, 1920, the sales taxes originating in the motor vehicle industry amounted to $145,963,000.

Five bills, introduced by Representatives Gordon Lee of Georgia, James B. Aswell of Louisiana, Edward B. Almon of Alabama, J. M. Robisn of Kentucky and Cassius C. Dowell of Iowa, provide for the expenditure of $100,000,000 a year for road construction, the time limit varying from two to five years.

Congressman Osborne of California has introduced a bill appropriating $1,700,000,000 over a term of eight years and the creation of a federal highway commission.

A bill prepared by the Eecutive Committee of the American Association of State Highway Officials provides for the limiting of federal aid funds to the improvement of systems of roads in each state, consisting of not more than 7% of the state mileage, 3% of the roads to be of interstate importance and the other 4% of inter-county importance. The bill provides that 60% of federal aid funds shall be spent on the roads of interstate importance until the system is completed. The bill also provides that the states **must** maintain federal aid roads. This bill was introduced by Senator Dowell at Iowa.

It is planned by Senator Townsend, Chairman of the Senate Committee on Roads, to hold numerous hearings on good roads legislation and to go very thoroughly into the study of the nation's road requirements.

Arkansas

A bill giving Little Rock one-half of the road tax collected in the city has been signed by the governor.

The bill introduced by Senator Jackson providing for a tax of 1 ct. a gallon on gasoline has been signed by Governor McRae. Half of this revenue will go to the county where collected and the other half will go to the State Highway Department.

California

The Ream Bill, proposing a tax of 1 ct. per gallon on gasoline, was killed in the Assembly Committee on Revenue and Taxation.

Connecticut

Appropriation bills in the legislature call for $18,000,000 for road and bridge work during the next two years.

The governor has signed a bill prohibiting the placing of advertising on private property along highways without the owner's consent.

A bill providing for the taking over of certain roads in New Hartford, Barkhamsted and Canton as state highways has been signed by the governor.

Florida

A bill has been introduced in the Senate providing for raising of the inspection fee on gasoline from $\frac{1}{8}$ to 1 ct. per gallon. Last year under the old fee $55,000 was collected.

No. 100, introduced in the Senate by Mr. Singletary, authorizes the sale of the state lands in the Everglades, 15% of the proceeds to be used in road work.

No. 94, introduced in the Senate by Mr. Plympton. authorizes the State Road Department to accept $400,000 of country road bonds from Columbia County as the country's share for the construction of state roads.

No. 101, introduced in the Senate by Mr. Eaton, would validate the $100,000 bond issue to be issued by District No. 4, Polk County.

No. 104, introduced in the Senate by Mr. Eaton, would validate the $25,000 bond issue to be issued by District No. 5, Polk County.

No. 267, introduced in the House by Mr. Tillman, would prohibit District No. 1, Alachua County, borrowing further money for road work under Chapter 8,229, Acts of 1919.

Louisiana

The Roads Committe of the Louisiana Constitutional Convention has finally adopted the pay-as-you-go plan of Ex-Governor Sanders, rejecting the plan of P. M. Milner, who proposed a $27,000,000 road bond issue. The final report of the committee recommends that the Legislature be authorized to establish a state system of highways and bridges under the supervision of the Board of State Engineers, the creation of a state highway fund, derived from the present ⅛ mill tax, which may be increased to ½ mill, minimum license fees of $15 for passenger cars, $25 for trucks, $5 for motorcycles and a tax of 2 ct. per gallon on gasoline. No bonds are to be issued and all road money is to come from current revenues. It is estimated that a graduated system of motor vehicle fees and the gasoline tax will yield about $6,000,000 annually.

New Jersey

Governor Edwards has signed the bill giving the state highway commissioners salaries of $4,000 a year. The governor also signed a bill providing for counties to outline advance programs for highway improvement for approval by the State Highway Commission and also a bill authorizing the State Highway Commission to enter into agreements to take over toll roads and bridges. The bills providing for the taking over of about 500 mi. of roads as state highways were vetoed.

New York

In the closing hours of the session the Legislature adopted a resolution providing for the creation of a joint legislative committee of three senators and five assemblymen to investigate the causes of automobile accidents within the state, the method of licensing chauffers and operators, the revocation of licenses and generally the whole subject of motor vehicle regulation and control by the state. The committee will report before Feb. 1,1922.

Governor Miller has signed Assembly Bill No. 1585, appropriating $7,954,747 for payment by the state in the first instance of the Federal Government's share in constructing rural post roads.

No. 899, introduced in the Senate by Mr. Hewitt, appropriating $1,934,676 for the contributions of the state to counties for highway improvement, has been signed by the governor.

A bill amending the general business law in relation to the licensing of professional engineers and land surveyors is now in the hands of the governor. As originally introduced by Mr. Ferris, the measure struck out the provision of the present law which permits corporations and partnerships to practice professional engineering. Considerable opposition was met and the bill was changed to conform with the present law. Accordingly, the effort to bar engineering corporations and partnerships from practicing engineering has failed.

North Carolina

A law went into effect on April 20 which imposes a tax of ½ ct. a gallon on gasoline. It is expected that the tax will yield $500,000 annually. The tax is levied only on gasoline used in motor vehicles. A law was also passed raising motor vehicle fees about 25%.

Pennsylvania

The Eyre Bill, providing for the exchange of $11,800,000 short term road bonds issued last spring for long term bonds with higher interest, has been signed by the governor.

The report of the Delaware River Bridge Joint Commission has been filed with the clerk of the House and recommends the appropriation of $5,000,000 to be made at this session.

Rhode Island

The General Assembly has passed a law increasing motor vehicle fees. Registration fees on passenger cars are 25 ct. per horse power and 25 ct. per 100 lb. gross weight. Vehicles with solid rubber tires pay 35 ct. per 100 lb. and trucks with iron tires pay $.50 to $1.00 per 100 lb. This measure will bring $200,000 additional revenue.

South Carolina

The Legislature passed an act authorizing Greenville County to vote on a $500,000 road bond issue. Another act passed by the Legislature authorizes a $100,000 bond issue to refund the county's past indebtedness for road improvements, the interest rate not to exceed 6%.

Tennessee

A bill has been passed by the Legislature which gives 25% of motor vehicles fees to the State Highway Department, the remainder being given to the counties where collected.

A bill which provides for the levying of 1 ct. a gallon on gasoline has been passed by the Legislature. It is estimated that the revenue from this tax will be about $350,000 annually.

A tax of one mill for highway work is provided in a bill which has passed the legislature.

West Virginia

The House on April 18 passed a bill raising the legal rate of interest from 6 to 8%.

The bill providing for the creation of a state highway commission of three members and the issuance of $20,000,000 of the authorized $50,000,000 bond issue, has passed the Senate.

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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HIGHWAY ENGINEERS AND THE PUBLIC

The engineer's relation to the general public has been the subject of much discussion. As a rule, engineers take too little part in public affairs, except as such participation is necessitated by their everyday work, and they put themselves forward far less than do members of other professions no more worthy than their own. Because of this attitude, not only is the engineer underestimated by his fellow citizens, but the public loses the benefit that it would derive if the engineers brought their konwledge and experience to bear in the shaping of public opinion.

There is plenty of opportunity for engineers to seek recognition of themselves and of their work—and recognition seldom comes unless it is sought. Especially is this true of highway engineers, for their work is of more general interest to the public than is that of most other engineers. Probably it is also more often appreciated; certainly failures in it are noticed frequently and emphatically enough.

Because their work means so much to the average citizen, highway engineers are less excusable than others for their failure to do their duty to themselves and to society.

The benefits to engineers of a greater appreciation of their work are obvious. The benefits that would accrue to the community should be quite as evident. The average road user knows a good road when he sees it, but that is about all he does know. It is unnecessary, of course, that he should know very much, if anything, about the technic of road building, but there are certain phases of highway improvement upon which he should have some information. Any engineer who is doing, or who has ever done, public work knows what they are.

The future of highway improvement—in its economic as well as its technical aspects—depends chiefly upon highway engineers. Upon the country's road program depends in great measure the future of transportation, which, in turn, is vital to the nation's progress—industrial, commercial and social.

The highway engineer's duty is great—his opportunity no less.

MORE ANENT THE "IDEAL" ROAD

Advocate of various types of pavements notwithstanding, there is not now any pavement that can be hailed as the "ideal" pavement.

This country is large. Its climate varies; its soil varies; the density of population, and, therefore the concentration of traffic varies; and all of these vary within wide limits. In addition, different building materials are available in different sections and construction facilities, including labor and transportation, are by no means the same in all places.

For these reasons, probably there never will come a time when it can be said that a given type of pavement is the ideal type.

In spite of the non-existence of this much sought road surfacing (and of the probability that it never will exist) it occasionally becomes desirable to advert to the subject not with any intent to discourage investigations and experiments that will aid in evolving a type more nearly approaching the ideal, but rather to encourage study of the very pressing problems incident to the art and science of road building to the end that highways may be improved by the laying of those pavements best adapted to the conditions obtaining in each case.

In order even to approach the ideal a pavement must fulfill a large number of requirements.

What is perhaps the chief of these is passability at all times. No pavement not usable 365 days in the year can be ideal—except, perhaps, in a summer resort that is absolutely deserted during the winter, or in some similar location. Nearly everywhere, motor-driven vehicles make up the traffic that has to be accommodated and the motor vehicle is more and more being used the year round. Fewer and fewer passenger cars are "put up" during the winter months and the only hindrance to year-round motor transportation is the impassability of some of the roads.

It is evident, therefore, that the pavement on the "ideal" road will be one unaffected by the destructive agents of winter. In like manner, it would be possible to point out the other requirements of the ideal—to draw a set of specifications. This one example, however, will suffice to indicate the magnitude of the task that confronts road builders in their efforts to improve upon existing surfacings and devise new ones more nearly meeting the requirements of present traffic.

Though an "ideal" pavement seems an extremely improbable achievement in highway engineering, the development of standard types for use under given sets of conditions in the different parts of the country can be looked upon as a reasonable outcome of the efforts of highway engineers.

Bureau of Public Roads to Study California Road Problems

The U. S. Bureau of Public Roads will cooperate with the California State Highway Department in conducting tests on soils of California and in determining the types of pavement to be used to meet the conditions peculiar to certain sections of the state. It is also announced that the bureau will open a regional office in San Francisco, with Dr. E. C. Hewes, who conducted the recent study of California highways, in charge.

Following a long series of experiments it has been discovered that the difficulty in building lasting roads on such soils as adobes and clays is due generally to the presence in these soils of colloidal matter, a glue-like substance capable of extraordinary absorption and retention of water. Colloids have been extracted from the soil, with the result that the soil has been deprived of its extraordinary quality of absorption. In building roads over clays and adobes, engineers have found that the expansion and contraction of the subgrade have resulted in cracks in the surface slab and so far the attempt to overcome this has been confined to increasing the thickness of the cement slab. The experiments now to be made will be concerned chiefly with the chemical treatment of the soil to neutralize its colloidal properties and render the subgrade able to support the concrete slab.

Road Work in England

In 1914 England and Scotland spent £19,000,000 on road work, according to Sir Eric Geddes, Minister of Transport. In 1920 about £33,400,000 were expended and for 1921 it is estimated that £45,000,000 will be spent on road work. (Since England, including Scotland and Wales, has an area about one-twenty-fifth of the area of the United States, her road expenditures as relative to areas is about eight times that of this country, although the per capita road expenditure in this country is approximately one-half greater than the per capita expenditure in England.)

The classification of English roads is now complete, having been classified as follows: England and Wales, first class roads, 11.6%; second class roads, 7%; Scotland, first class roads, 17.9%; second class roads, 13.1%.

"The old petrol taxes," says Sir Eric Geddes, "yielded some £2,500,000 a year and the new petrol taxes are estimated to yield £8,500,000 a year. Up to the end of March, 1921, the petrol taxes have yielded £7,785,000."

Work Progresses on Hartford-New London Highway

About 20 mi. of the 32 mi. of the Hartford-New London (Conn.) Highway will be completed this year, according to an announcement by the Connecticut State Highway Department.

This road will shorten the distance between the two cities by 12 mi. The work on the road has been divided into four sections by the contractor, Blakeslee & Sons, of New Haven. Each section requires considerable grading work. The first section, from Glastonbury to Marlborough, 8 mi., involves the removal of 44,000 cu. yd. of earth; the second section from Marlborough to Colchester, 26,000 cu. yd. The total cost of the improvement is estimated at $1,800,000 of which $643,720 will come from federal aid funds. The pavement will be of concrete, 8 in. thick at the center and 6 in. at the sides.

Ohio State Highway Department Will Open District Offices

The Ohio State Highway Department will establish eleven district offices in various parts of the state, according to an announcement of Leon C. Herrick, State Highway Commissioner. The offices will be located at Columbus, Lima, Springfield, Chillicothe, Ottawa, Findlay, Elyria, Ravenna, Xenia, Martins Ferry and Newark. The division engineers who now make their headquarters at Columbus will be placed in charge of the new offices.

Lincoln Highway "Ideal" Section

The letting of the contract for the construction of the "Ideal" section of the Lincoln Highway has been placed in the hands of Lockwood, Green & Co., of Boston, Mass. W. G. Thompson, formerly state highway engineer of New Jersey and now connected with the Lakewood Engineering Co., will be in charge of the final detailed design of the section. Jens Jensen of Chicago, Ill., has been engaged as landscape architect of the section. The detailed designs and plans prepared for the section will be made public as soon as completed and the actual construction will be undertaken as soon as possible.

The Oregon State Highway Commission recently received a bid of 97.88 on $1,000,000 highway bonds, bearing 5½% interest and maturing in four years. These are the first bonds to be offered under the new law authorizing the issuance of short term bonds at an interest rate to be fixed by the commission.

Connecticut Bill Would Fine Negligent Pedestrians

As has been noted in a previous issue, a bill has been introduced in the Connecticut Legislature which imposes a fine of $25 upon pedestrians who use the highways of the state in a reckless manner. A correspondent has suggested to us that the bill be amended by the inclusion of the traffic code for pedestrians, by E. C. Wilman of Rochester, N. Y., which follows:

"Pedestrians crossing a boulevard at night shall wear a white light in front and a red light in rear.

"Before turning to right or left, the pedestrians shall give three short blasts on a horn at least 3 in. in diameter.

"When an inexperienced driver is made nervous by a pedestrian, he shall indicate the same and the pedestrian shall hide behind a tree until the automobile has passed.

"Pedestrians shall not carry any substance in their pockets which when broken will be apt to cut tires.

"In dodging automobiles pedestrians shall not run more than 7 mi. an hour.

"Pedestrians must register at the beginning of each year and pay a license fee of $5.

"Each pedestrian before receiving his license to walk upon the highways must demonstrate before an examining board his skill in dodging, leaping, crawling and extricating himself from machinery."

Highway Work in Pennsylvania

Twenty-one contracts for the construction of 84 mi. of highway have been let by the Pennsylvania State Highway Department this year. These contracts involve an expenditure of over $5,000,000. About one-fifth of this work is in Mercer County, the contracts for road construction in this county amounting to $1,000,000.

Freeholders of Cape May County, New Jersey, Charged with Waste

The Board of Freeholders of Cape May County, New Jersey, was charged with irregularities relative to the expenditure of approximately $900,000 of road funds, in a report made April 12 to the grand jury by Justice Charles U. Black of the Supreme Court. The report was based on four months of investigation of the affairs of the county by a special committe appointed by the court.

Judge Black advised the grand jury that unless it found indictments against the persons involved he would discharge its members and call another jury.

In addition to "extravagant expenditures of money in road building, careless management and inefficiency," it is also charged that the county had more than $400,000 deposited in one bank despite the fact that no interest was paid on this money.

Story County, Iowa, Sued for Failure of Railing on Temporary Bridge

A suit for $20,000 has been filed against Story County, Iowa, by the administrator of a man drowned when the automobile in which he was traveling broke through the railing of a temporary bridge across Squaw Creek. The temporary structure was erected to take the place of a bridge that had been washed out.

Government Must Pay Insurance and Bond Premiums on Contracts

An important decision was handed down by the U. S. Court of Claims on April 18, giving judgment to the Northeastern Construction Co. and the Mason & Hanger Co. These companies brought action for reimbursement of premium on surety bond and also cost of liability and other insurance furnished under the cost plus form of contract in use during the war and the court held that insurance and bond premiums were properly items of cost. The accounting officers of the Government have consistently declined to approve items of this kind and this decision will enable thousands of contractors to recover similar expenditures.

Alleges Ohio Contract Was Awarded Illegally

Upon application of Henry P. Streicher to the Franklin County, Ohio, Court, an order has been issued enjoining the state highway commissioner and other officials from proceeding with the improvement of the Upper Sandusky-Findlay Road. It is alleged that the contract was awarded to Richard H. Schafer and William E. Dorsey by fraudulent agreement with former State Highway Commissioner Taylor.

Bids on the road, it is alleged, were opened last June and Dorsey bid $138,332 and Streicher bid $124,104. Commissioner Taylor declined to award the contract. In October bids were again requested, it being announced that the state would do about $40,000 worth of the work. When bids were opened it was found the Shafer had bid $102,941, the Highway Construction Company $103,156 and Streicher $105,987. More than a month after the bids were opened, the petition recites, the contract was let to Shafer and later transferred to the Johnson Construction Co.

Mercer County, New Jersey, Files Claim Against U. S. For Road Damages

A claim of $40,000 for damage to the roads of Mercer County, N. J., by army trucks during the war has been filed against the federal government. Roads involved in the claim are the Mercerville-Windsor, White Horse-Yardville and White Horse-Bordentown Roads, which connected Camp Dix with New York City and Philadelphia. Other counties of New Jersey, it is said, will present similar claims against the Government.

HIGHWAY TRANSPORTATION

Trailer Trains in San Joaquin Valley

The White Lines Operate Trains on Daily Schedule Between Stockton and Fresno, Cal.

"The White Lines" are engaged in freight transportation in the San Joaquin Valley, California, where the roads are well built and where there is a sufficient volume of business to warrant operating trucks and trailers on a definite schedule which is steadfastly adhered to. The service which they render indicates clearly the relief which motor trucks will be able to provide for those having commodities to ship, as the construction of highways progresses in this country.

MACK TRUCKS AND TRAILERS WITH FORD CAR AND TWO FEEDER SEMI-TRAILERS ON BOARD

The territory served so effectively by "The White Lines" is one of the most productive agricultural regions in the far West. The general offices of the company are at Stockton, Cal., the northern terminus of the route. Branches are maintained at Modesto, Turlock, Merced and Fresno, the last named being the southern terminal. In addition to these offices, the company has representatives in all of the smaller towns along the way. These resident agents bring in freight from their territory in small feeder trucks to the local shipping platform where it is loaded to the through trains with very little delay.

All of the company's long-distance hauling is carried on by five Mack trucks used in conjunction with 16 trailers, which vary from 2½ to 10 tons capacity. Nine other small trucks are used for feeder service along the line.

Chain-driven trucks make daily trips with average loads of from 20 to 30 tons. One train is started from Fresno and one from Stockton at 5 a.m. The distance one way between these two points is 125 mi. The actual running time for this distance is nine hours, but the trip takes twelve hours on account of stops made to pick up and discharge freight. The trips are made six days a week, and at present 1,000 tons of freight a month are being hauled. The cost of this transportation is slightly higher than the railroad freight rates, but considerably lower than express service. Patronage is secured through quicker delivery, reliability, and better condition of goods on arrival.

"The White Lines" have used paid newspaper space and direct mail advertising extensively in going after business. However, the major part of the traffic has been secured through personal solicitation. The general advertising and mail campaigns were valuable largely in paving the way for the company's representatives through educating the public to the use of motor transportation. Definite time-tables and rate sheets are supplied to all shippers along the line, and the combination of all these efforts has resulted in a steady increase of business, month by month, since the company was organized. Before the trains are started from Fresno and Stockton, reports are received from all points along the way in regard to the space requirements of each station. The train is made up according to these reports. When a large quantity of freight is consigned to any one town it is placed on a trailer of suitable capacity and the trailer is left at that station and replaced by another. Great economies of time are effected in this way .

The trains operated by this company transport a maximum of freight with the least possible amount of road wear. The use of trailers distributes the weight of the load so that no portion of the road is subjected to any more pressure than would be the case if smaller trucks were run over it. Furthermore, the use of trailers reduces unsprung weight to a minimum as there is no weight below the springs except that of the wheels and a light axle. The importance of this can be readily recognized when it is remembered that tests conducted by the U. S. Bureau of Public Roads have shown that weight carried below the springs is one of the controlling factors in road wear.

To be sure, the cost of motor transportation decreases as the unit load capacity increases, but perhaps of even greater importance than this has been the carefully worked out system employed by "The White Lines" and their rigid adherence to time schedules. Their ability to perform satisfactorily the service which they have undertaken has been the vital factor in gaining for them the good will of shippers in California. As "The White Lines" are now planning to extend their route another 125 mi., making a total round trip of 500 mi., it is quite obvious that the service is appreciated.

The Economics of Highway Transport

By Roy D. Chapin

(Continued from April 20)

No one questions the necessity for better highways, nor the utilitarian value of the vehicles that traverse the roads. The problem that rears itself straight in front of us is the proper administration to secure the largest returns from this tax upon each individual, also the education of men to help direct highway expenditures. In other words, let the public get back more than a dollar in dividends for every dollar spent, and let it be handled by men adequately trained. We have appropriated money and built highways with more consideration for the actual mileage constructed than for the quality of the road itself. The leaders today in highway building are not content to locate highways based on political pressure or local sentiment. A careful traffic census, plus a sound vision of future travel, answers "Yes" or "No" to what roads should be built. Railroad engineering has shown that too heavy grades add millions to haulage costs. Too sharp curves cut down speed and throw heavy wear and strain on tires. The rougher the surface, the higher the maintenance cost of the vehicle and the greater the discomfort to the person in it, to say nothing of the sharper impact on the road surface. Human life must be protected, dangerous crossings eliminated or safeguarded, and traffic rules rigidly enforced. Foundation and drainage have come to long periods of years. We should not let competent men resign, as has one of the well-known state highway engineers of the country, because his state was not willing to pay his assistants enough to hold good men. It is the hidden strength in the foundation, that the user of the road never sees, which tells whether the taxpayers' money has been wisely administered. The builders of fine motor cars put many dollars into the construction of their chassis in quality of material, extra weight at points of strain, and great care in workmanship, which the owner of the vehicle only senses in the satisfaction that its yearly use gives. It is not apparent on the surface.

The time is here when we must treat the highway and its vehicle as a unit, one wearing upon the other, and study each in turn in its relation to the economic fabric of the country. We must design the road to fit the vehicle and equally design the vehicle to fit the road. Here we have a problem that concerns engineers, taxpayers, legislators, and each and every one of our population, for all of us use the highway.

Over the past twenty years our citizens had a false impression of our duty toward the railroads. Discrimination against them touched the popular fancy. Railroad executives will tell you that they too could have handled their trusts better in relation to the public. Since the beginning of the war, we have seen the railroad companies take several billions of dollars of the taxpayers' money to keep the wheels moving—not because they wanted to, but because the public had to have this service and must have it at any cost. Since the war we all understand better the importance of railroad transportation and the necessity of according it fair treatment.

The war was responsible in bringing home to us how close our highways are to our everyday life. An unusual strain was placed upon them, both civil and military, and we all came through the war with a heightened desire for better roads everywhere as soon as possible. The Highways Transport Committee of the Council of National Defense, which was entrusted by the Government with the energizing of highway transport during the war, adopted the following platform that is still significant in its vision of the duty of each form of transportation.

"It is the aim of our committee to cooperate closely with railway, electric railway, and waterway transportation, and it is to be clearly understood that in no way is the committee encouraging competition between the various forms of transportation, but rather the carrying of any type of freight by the particular means which can do it the most efficiently, quickly, and economically."

Here is a platform that can stand for some time in its economic interpretation of the field of highway transport.

The public must have highway service, but such service must recognize its own responsibilities. There is time to sit down and forecast much that needs to be done. Sound analysis should be put on these problems and unanimity reached by the best thought in the country. Let me suggest a few of these.

How much shall be spent to build a particular piece of highway?

What expense is warranted to maintain that piece of highway?

What type of surface should be laid for the different geographical sections?

What maximum traffic must be prepared for?

How shall highway bonds be made "gilt-edge"?

How shall we divide the responsibility of the Government, the state, and the county for highway construction, control, and maintenance?

What proportion of the cost shall be borne by the vehicle?

How can the cost of vehicle operation be cut down?

What are sane regulatory laws?

How shall we tie highway, railway, and water transportation together so that they will not compete but will serve each other?

How, finally, shall we make highway transport serve to cut the cost of living—how add even more to the satisfaction of human desire?

These are all basic problems that call for the correlation of thinking men's minds. Certainly efforts should be made to continue in office those highway officials who have demonstrated their ability and foresight. France far outstrips us in the perfection of her system of highways, and France makes sure that she retains her capable highway officials over highest salary of any state official. When we speak of billions in connection with highways, we must realize that the right brains can be commanded only by paying adequate salaries.

The United States Government should unquestionably be the leader of forward thought pertaining to highway transport. Already it has appropriated $285,000,000 for highways from the national treasury. Hundreds of millions are to follow, because the American people insist that the Government not only help build its main highways, but they also want the benefit of a centralized authority permanently engaged in research and investigation to help them solve some of these problems already enumerated. The Government should assume its responsibility by determining what are the national highways, asking the states to designate state highways, and the states in turn obtaining from the counties a designation of the county highways. We would then have a plan of country-wide roads upon which can be based the expansion over those roads of a transportation system that shall make of every farmer's gate a shipping platform, a medium for the transfer of people and goods that will advance us far beyond any other nation.

Our progressive schools and colleges have already started to train students to think along these lines. Every day more institutions of learning are taking up the subject. It has the romance and calls for the vision that appeals to the American type of mentality.

Let the Government and the people insist on the solution of the economic problems involved and we shall set an example for all other nations. The world is just awakening to the manifold advantages of highway transport. We, in America, have the opportunity to lead the way. Let our sons not think us heedless of our duty or blind to the economic problems involved in this absorbing question, but rather let us intelligently set to work that our children may reap full benefit of our foresight.

The New Jersey State Highway Department has purchased a core drill and will take samples of various pavements laid in different parts of the state.

The State of Pennsylvania plans to sell $15,000,000 of road bonds in July. This will leave a balance of $11,200,000 of the $50,000,000 bond issue authorized in 1919, to be sold in 1922.

Illinois Officials Inspect Wisconsin Highways

Governor Small of Illinois, members of the Legislature, and highway officials recently made an inspection trip of the roads of southern Wisconsin. The governor and other officials of Wisconsin met the party at the state line.

Opposes "T. R." Signs on Canadian Road

Permission to paint "T. R." on poles along the proposed link in the Theodore Roosevelt Highway in Ontario, Canada, has been refused by F. C. Biggs, Minister of Public Works of Ontario, according to a recent report.

Miners Working on Roads Protest Cut in Wages

Because Allegany County, Maryland, has reduced the wage scale for road workmen from 50 to 37½ ct. per hour, miners who are now working on the roads have protested against the decrease. Resolutions by mining locals have been passed urging the restoration of the former wage.

Indiana Will Pay for Road Materials Delivered on the Job

The Indiana State Board of Accounts has ruled that contractors may be paid up to 70% of the value of materials delivered on the job. It was explained that this action was taken because of the economic conditions and would be in effect until further notice, but would not continue later than Dec. 31, 1921.

Headley Good Roads Company Opens Chicago and St. Louis Offices

The Headley Good Roads Co., Philadelphia, Pa., has opened a Chicago, Ill., office with W. Kuhlmey in charge, and a St. Louis, Mo., office with W. J. Roehl in charge.

Allegheny County, Pennsylvania, Buys Asphalt Plant

Allegheny County, Pennsylvania, has purchased an asphalt plant which is expected to be delivered to the county shortly. The plant will be set up at North Bessemer. County Road Commissioner Schooley had recommended the purchase of three plants but the county commissioners voted to buy only one.

"The Original Cold Patch"

A booklet describing Headley No. 1 and bearing the above title has recently been sent out by the Headley Good Roads Co., Philadelphia, Pa. This booklet describes and illustrates the use of the cold patching materials manufactured by the company.

Another illustrated booklet recently issued by the Headley company describes the use of Headley No. 1 for grade crossings, platforms and similar work.

MEETINGS

Calendar of Coming Meetings

May 9-11.—American Association of Engineers.—Seventh annual convention, Buffalo, N. Y. Secretary, C. E. Drayer, Chicago, Ill.

May 10-12.—Canadian Good Roads Association.—Eighth annual convention, Halifax, Canada. Secretary, George A. McNamee, 909 New Birks Bldg., Montreal, P. Q.

May 13—National Highway Traffic Association—Annual meeting, Automobile Club of America, New York, N. Y. Secretary, Elmer Thompson, 247 W. 54th St., New York City.

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

National Highway Traffic Association

The annual meeting of the National Highway Traffic Association will be held at the Automobile Club of America, New York, N. Y., on May 13 at 8:00 p.m. An informal dinner will be served in the grill room of the club at 7:00 p.m.

Besides the election of officers and the receiving of reports of the officers of the association, the following papers will be presented: "Relation of Methods of Financing Highway Improvements to Present and Future Traffic." by J. E. Pennybacker, Secretary of the Asphalt Association; "Highway Improvements Should be Based on Transportation Surveys." by Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport, University of Michigan; Report of the Committee on "Sign Posting for Detours and Through Routes in Municipalities," Chairman, Elmer Thompson, Secretary of the Automobile Club of America; Report of the Committee on "Regulation of Overloading of Motor Trucks," Chairman, David C. Fenner, Manager, Public Works Dept., International Motor Company; Report of the Committee on "Regulations Covering Speeds, Weights and Dimensions of Motor Trucks and Trailers," Chairman, George H. Pride, President, Heavy Haulage Co., New York, N. Y.

Northern Michigan Road Builders' Association

A joint meeting of the Northern Michigan Road Builders' Association with the Upper Peninsular branch of the American Contractors' Association was held on April 8 and 9 at Marquette, Mich.

Among the speakers were Frank F. Rogers, State Highway Commissioner of Michigan; L. H. Neilsen, Deputy State Highway Commissioner; G. C. Dillman, Maintenance Engineer of the Department; and Arthur H. Blanchard, Professor of Highway Engineering and Highway Transport at the University of Michigan. Commissioner Rogers and Deputy Commissioner Neilsen held a series on conferences with road commissioners in the district.

K. I. Sawyer was elected president of the association; J. H. McCarthy vice president, and R. P. Mason secretary.

American Society of Mechanical Engineers

The 1921 spring meeting of the American Society of Mechanical Engineers will be held at the Congress Hotel, Chicago, Ill., on May 23-26. The materials handling session will consider matters of interest to the road builder. Papers will be presented as follows: "Planning and Organization of a Road Job for the Mechanical Handling of Material," by C. D. Curtis; "Road Plant Operations, with Practical Analysis of Operating Road Plants," by B. H. Piepmeier; "What the Contractor Needs," by General R. C. Marshall, Jr. Instead of excursions a number of moving pictures will be shown in which the uses of road building machinery will be displayed.

Jamestown Automobile Club

State Commissioner of Highways, Herbert S. Sisson, was the principal speaker at the annual banquet of the Jamestown Automobile Club at Jamestown, N. Y., on the evening of Monday, April 25. Other speakers included Assemblymen Joseph A. McGinnies and J. S. Wright, representatives from Chautauqua County in the State Legislature.

Commissioner Sisson spoke chiefly of the plans of the Highway Department for the coming year, with especial reference to Chautauqua County and the provisions of the Hewitt Bill with reference to it. He also referred at some length to the matter of maintenance and the department's efforts in that work.

Assemblyman McGinnies explained at length the financial situation of the state, particularly in its bearing upon road work in the state as a whole and in Chautauqua County.

The Kentucky Road Engineers' Association will hold its annual convention on June 7 to 10 in the Jefferson County Armory, Louisville, Ky.

The United States Good Roads Association held its annual convention on April 18 to 23 at Greensboro, N. C. Charles H. Brough, Ex-Governor of Arkansas, was elected president and J. A. Rountree reappointed director-general of the association.

PERSONAL MENTION

C. E. Rice has been appointed city engineer of Wooster, O.

J. P. Brownell has been appointed city engineer of Carthage, N. Y.

A. J. Teed has been appointed city engineer of Cadillac, Mich.

W. C. Cooper has been appointed city engineer of Kalispell, Mont.

Theodore Lancott has been appointed city engineer of Hull, P. Q. Canada.

W. V. Taylor has been appointed city engineer of Sarnia, Ont., Canada.

Charles H. Schultz has been appointed city engineer of McKinney, Tex.

C. H. Henning has been appointed county engineer of Hill County, Texas.

Bryant & Huffman have resigned as county engineers of Hill County, Texas.

Phineas Page, Jr., has resigned as highway superintendent of Niskayuna, N. Y.

W. C. Jepson has been appointed city engineer of Niagara Falls, Ont., Canada.

Warren E. Moore has been elected commissioner of public works of Oklahoma City, Okla.

Charles E. Bower has resigned as county commissioner of highways of Steuben County, New York.

A. E. White has been appointed a division engineer of the New Hampshire State Highway Department.

E. S. Hastings has been appointed a division engineer of the New Hampshire State Highway Department.

William G. Kellogg has been appointed county commissioner of highways of Steuben County, New York.

B. G. Michel has resigned as city engineer of Kitchener, Ont., to enter the contracting business.

John L. Snead has been appointed resident engineer at Richmond for the Virginia State Highway Department.

W. R. Talbot has been appointed engineer for the Good Roads Committee of the Danville, Va., Chamber of Commerce.

Frank S. Peck, formerly State Highway Engineer of South Dakota, is now highway engineer of Minnehaha County, South Dakota.

C. H. Peterson has been appointed city manager of Mt. Pleasant, Mich. Mr. Peterson was formerly city engineer of Cadilac, Mich.

Charles T. Male, an instructor in mathematics at Union College, has been appointed highway superintendent of Niskayuna, N. Y.

Norman F. Brown has been appointed director of public works of Pittsburgh, Pa. Mr. Brown was assistant to the chief engineer of the Pennsylvania R. R.

B. H. Tong has been appointed superintendent of highways of Emmons County, North Dakota. Mr. Tong was formerly assistant city engineer of Bismarck, N. D.

Ernest S. Alderman has been appointed state engineer of Oklahoma. Mr. Alderman was senior highway engineer, stationed at Oklahoma City, of the U. S. Bureau of Public Roads.

Samuel J. Humes, formerly County Engineer of King County, Washington, has organized the firm of consulting engineers known as Samuel J. Humes & Co., with offices at Seattle.

OBITUARY

Lester G. French, Editor of "Mechanical Engineering", the official journal of the American Society of Mechanical Engineers, died on April 18.

John H. Bloomshield, for more than a score of years engineer of the Bay City, Mich., Bridge Commission and highway engineer for the Bay County Road Commission, died in Bay City on March 18.

Samuel E. Tinkham, Engineer of Construction of the Bridge and Ferry Division of the Boston Department of Public Works, died on April 21. Mr. Tinkham was secretary of the Boston Society of Civil Engineers for nearly 40 years.

PUBLICATIONS

LOCATION, GRADING AND DRAINAGE OF HIGHWAYS. By Wilson G. Harger. First edition. Cloth, 6x9 in., 294 pages. Illustrated. McGraw-Hill Book Company, New York, N. Y.

This book is the first of a series of four volumes, each of which will cover separate phases of highway engineering. This first volume covers thoroughly the matters taken for its subject and is a most thorough presentation of the best practice in road location, grading and drainage. This book presages well the value of the forthcoming volumes.

KANSAS STATE HIGHWAY COMMISSION. Standard Specifications for Road, Bridge and Culvert Construction. Paper, 8x11 in., 131 pages.

This 1920 edition of the standard specifications of the highway commission contains in detail all the information necessary to a contractor desiring to bid on road work in Kansas. The subjects covered are carefully indexed at the end of the book.

Washington University, St. Louis, Mo., will inaugurate a course in highway engineering next year.

Scotland Neck, North Carolina, a town of about 2,000 population, will issue $250,000 of 6% road bonds.

Exports of Road Machinery in March totaled $107,865. Exports of road machinery during the same month last year totaled $120,331.

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*Illustrated Article

Concrete Roads must be reinforced

It is demonstrated beyond doubt that to make concrete roads proof against heavy motor traffic, weather and time a fabric of steel must be incorporated in the concrete.

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President Harding *Urges* Road Maintenance. *He says—*

"I KNOW of nothing more shocking than the millions of public funds wasted in improved highways, wasted because there is no policy of maintenance. The neglect is not universal, but it is very near it. There is nothing the Congress can do more effectively to end this shocking waste than condition all Federal Aid on provisions for maintenance. Highways, no matter how generous the outlay for construction, cannot be maintained without patrol and constant repairs."

EXTRACT FROM FIRST MESSAGE
TO CONGRESS, WASHINGTON, D. C.
APRIL 12, 1921

Road patrol maintenance crew patching improved road with "Tarvia-KP"

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GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE
WITH WHICH IS INCORPORATED
THE HIGHWAY CONTRACTOR AND ROAD BUILDER

Old Series, Vol. LX
New Series, Vol. XXI
JAMESTOWN, N. Y., MAY 11, 1921
Number 19

The Good Roads Movement In Brazil

Santos - Sao Paulo Automobile Road — Types of Pavement — Little Labor Saving Machinery Employed—Many Problems Confront Road Development

As the use of the motor vehicle grows in the various countries of the world, the interest in better roads is stimulated. When a people are awakened to the advantages of motor transportation, a desire for passable roads springs up which by its insistence brings about the general improvement of roads. In South America we see the early workings of a good roads movement which will ultimately result in the construction of a system of highways which will develop the resources of the continent.

Brazil is the present center of the good roads movement in South America. In the Brazilian states of Sao Paulo, Rio de Janeiro and Rio Grande do Sul are more highways suited to motor traffic than in Argentina, Peru and Chile combined. Likewise here the interest in the extension of good roads is more intensified. Shortly after his election in 1917, President Pessoa declared for a more comprehensive plan of good roads development and has consistently maintained that it would be better to build more highways for the country's development than to attempt further railroad extension under existing conditions.

In the three states above, which are the leaders in progressiveness in the republic, the president's policy has been adopted. More recently the president of the State of Sao Paulo made his campaign chiefly upon the issue of better roads and he was elected by a handsome majority. At present a movement is under way to coordinate highway development effort along some definite policy, and the agitation has not only the federal government's support, and the individual state approval, but the hearty support of municipal officials, engineering societies and other organizations of the cities of Rio de Janeiro and Sao Paulo.

One of the most notable highway developments of recent years in Brazil was the building, largely by private subscription, of an exclusive automobile boulevard from the city of Santos, on the coast, to Sao Paulo, a distance of 50 mi. This highway was opened to the public early last year and one of its immediate effects has been to give a tremendous im-

BITUMINOUS MACADAM SECTION OF SANTOS-SAO PAULO HIGHWAY, BRAZIL

STREET IN RIO DE JANEIRO, BRAZIL, PAVED WITH NATIVE GRANITE BLOCKS petus to automobile sales in both cities. For the most part the land is fairly level, although here and there cuts were necessary and at one point considerable filling was necessary through a swamp. Moderate tolls collected will be applied to the maintenance of the road. The surfacing of the road is for the most part macadam, with bituminous surface treatment on some sections.

While Brazil is rather definitely committed to the good roads movement, its big problem is an effective method of financing the work. These questions are being considered individually by the several states and there seems promise of joint cooperation with the federal government that eventually will lead to the development of a national system of highways. Because of the great distances between cities and towns the problem of highway financing is particularly difficult.

In area Brazil is considerably larger than the United States, whereas her population is a trifle short of 25,000,000. This represents more people than all the rest of South America can boast, yet half of this population are Indians, scarcely more than half civilized. Rio de Janeiro with nearly a million people and Sao Paulo with half as many are the real mainsprings of the country.

Generally speaking, the streets of all the leading Brazilian cities are unusually well paved. Rio de Janeiro, Sao Paulo and Santos all have large mileages of paved streets and many Americn cities are not as well paved or do not keep their streets in as clean condition. Much of the pavement in Brazilian cities is of a particularly tough native granite, cut in blocks and laid on earth or sand foundation. Drives and boulevards generally are of asphalt, which material also prevails in the residential districts.

Street paving and excavation work is done by hand, although an American contracting firm having sewer contracts in Rio de Janeiro and Sao Paulo has used steam shovels. At the present time there are perhaps not have a dozen steam shovels in all Brazil. Increasing costs of hand labor, however, are stimulating local interest in modern American methods and machinery. Labor costs from $1.50 to $1.75 per eight-hour day and is not more than half as efficient as similar labor in America.

American contractors who have used improved methods in street and road work in recent years have given the Brazilians an insight into the possibilities of the use of labor saving machinery. There is a great potential market for all kinds of road machinery in Brazil.

The Avenida de Atlantic in Rio de Janeiro is one of the most beautiful boulevards in the world and unsurpassed in the United States. This avenue is paved with asphalt, is over 100 ft. wide and more than 10 mi. in length. The Avenida de Branco is the "Fifth Avenue" of Rio de Janeiro and is also paved with asphalt.

Because of climatic conditions in Brazil it is probable that most of the roads that will be built will be with top soil dressing.

The accompanying illustrations show a granite block pavement in Rio de Janeiro and a section of the Santo-Sao Paulo Road. The carts shown in the former are typical carts of the country. Incidentally, it may be of interest to know that the oxen of Brazil are a cross between the Indian zebu and native cattle and best withstand the ravages of tick, etc. The house appearing in the picture of Rio pavement seems to be of one story, yet several stories are below, a masonry retaining wall being on that side of the street. The other illustration shows a section of the Santos-Sao Paulo Road, which is of bitumious macadam construction. Other sections of this road are of macadam and top soil.

Research on Concrete Needed

At the recent convention of the American Concrete Institute, the Committee on Research reported that the following subjects should be studied:

Proper methods of measuring quantities going into a batch of concrete.

Collection and correlation of data to show quantity of set concrete which can be made from given amount of aggregates.

A standard field method for determining consistency of concrete.

A standard field test for strength of concrete.

Tests to ascertain the efficiency of various types of mixers in making concrete.

The allowable variations in sizing of aggregates.

An index of quality of aggregates as determining their value in concrete.

An abrasion test for gravel.

A method of evaluating various forms of mechanical anchorage of reinforcing bars in concrete beams and slabs.

The value of clay tile in with concrete beams in adding to the shearing value of the beam.

The production of plant mixed aggregate.

Relative values of rectangular and T-shaped or I-shaped reinforced concrete beams in resistance to shear.

A method of evaluating bent-up bars as shear reinforcement for concrete beams.

A study of corrosion in reinforcement in contact with salt water or salt air.

Bond stresses in two-way reinforcing, as in footings.

Adjustment of steel stresses due to plasticity of concrete.

Test of chuted concrete.

Central mixing plants.

The Automobile Club of America in New York City was the first motor club in this country, being organized in 1899.

Justifiable First Cost of Highways

*By J. E. PENNYBACKER

Determination of justifiable outlay for a proposed highway improvement from anticipated service should call for at least as careful survey and estimate as the engineer now provides for the engineering features preliminary to the construction of the highway. Thousands of miles of earth roads and thousands of miles of lightly surfaced and poorly designed gravel and macadam roads impose upon highway engineers of the nation the task of so parceling out insufficient highway revenue that it will be applied to the highways in proportion as they show traffic justification for improvement.

To incorporate this requirement into highway engineering practice is to make the traffic unit as widely used as the customary units of physical measurement. This measurement of justifiable outlay by the yardstick of traffic does not disregard the great beneficial influence of the highway upon social life and educational development in rural districts but, inasmuch as they go hand in hand with traffic development, the latter may in general be regarded as an index of both the direct and indirect value of the improvement.

Motor vehicle traffic predominates to such an extent as to make logical the adoption of a system of measuring costs and justifiable outlay primarily in units of this class of traffic. Thus, while the unit commonly used for horse-drawn traffic is the ton mile and applies to loads rather than to vehicles, it is necessary to adopt a unit which will take into account the eight and one-quarter million passenger automobiles now registered and the millions to come and which will allow credit to the highway for the saving in their operating costs. To substitute "vehicle mile" would not fully meet this need as the million trucks in use and those yet to come must be rated as deriving greater benefit individually than the passenger car. A simple plan sufficiently comprehensive to meet most needs is to retain the "ton mile" as the unit of measurement but to regard each passenger car and each one and two horse vehicle as the equivalent of one ton while the motor truck and the heavy team outfits would be regarded as the equivalent of the vehicle weight plus the load in tons. This plan would permit of a rapid traffic enumeration without complexity. Subdivision of the investigation to determine whether the route is to be for "heavy truck traffic" or for "light traffic" would require segregation of the heavy and light truck records respectively, but this would not affect the main purpose of the investigation, namely, to ascertain justifiable outlay.

Counting the traffic on the old road is manifestly an inadequate method of ascertaining total ton miles. After the highway is improved it will divert traffic from other highways, will stimulate local traffic so that more miles will be traveled in a given period, increase deliveries from and to market points, develop resources and finally, if it is on a trunk line or a route to scenic and recreational regions, will draw increased tourist travel. These various classes of anticipated travel may be termed "potential" and however difficult of exact estimate the investigator should give weight to them in his recommendation as to justifiable outlay. It is suggested that for the potential local traffic a zone be plotted to include the territory which might logically be served by the highway after improvement. Within this zone the investigator could make an approximate automobile census and so acquaint himself with the business, industrial and social possibilities of the zone as to establish a basis for estimating both the saturation point in motor vehicle ownership and the average mileage per car. In short, without attempting to present here the exact detail of a traffic survey, I do mean to urge the necessity and practicability of a traffic census which covers both existing and potential traffic.

Operating costs of motor vehicles are ascertainable and may be expressed in ton mile units. Costs of gasoline, oil, tires, repairs and depreciation, garage, chauffeur, taxes, etc., make a substantial total. How the figures look from a national standpoint may be gleaned from statistics. Thus, in 1920 the gasoline consumed by motor cars amounted to 3,200,000,000 gallons, worth nearly a billion dollars at prices paid by car owners. Tires are estimated by M. O. Eldridge, Director of Roads of the American Automobile Association, at one billion dollars a year. Lubricating oils to the extent of about 175,000,000 gallons, worth as many dollars, were required. Repairs and depreciation on 9,250,000 cars, if averaged at only $250 per annum, would yield a total of more than two billion dollars. License fees alone in 1920 aggregated about $1,000,000,000 and this together with costs for the garage, chauffeur, insurance and miscellaneous items makes it evident that on a conservative basis of estimating we can place the annual motor traffic cost at near five billion dollars or the equivalent of ten times the entire highway expenditures outside of cites. The average per car, if we use 9,250,000 as the number of cars and $5,000,000,000 as the annual cost, would be $540.00. If the average mileage is 5,000, the cost per car mile is 10.8 ct. Applied to ton miles the average would be somewhat lower as the trucks loaded would average 3 tons, thus making it probably 8.9 ct. As

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*Secretary, The Asphalt Association.

to whether such rate per mile is too high or too low on a given highway should be ascertained by the investigator. When he has determined upon the rate, however, and applied it to the potential ton miles, he has established the gross traffic cost on the highway for potential traffic if no saving were effected.

The cost of operation per ton mile on the old road should be ascertained and from this should be subtracted the estimated cost of operation per ton mile on the improved highway, established by comparative data of operating costs on highways similar to the type or types under consideration for the improvement. As the traffic cost per ton mile would be affected by the character of the highway improvement to be adopted, it is assumed that the engineer will base his comparison upon a type or types of improvement which appear to him practicable if they can be financed out of the traffic saving. In other words, this method leaves to the engineer the same direction as he now customarily exercises in selection of design, but subjects it to the test of financial justification. This saving in cost of traffic operation per ton mile when applied to the total existing and potential increase in ton miles gives the gross annual saving in traffic operation attributable to the improvement.

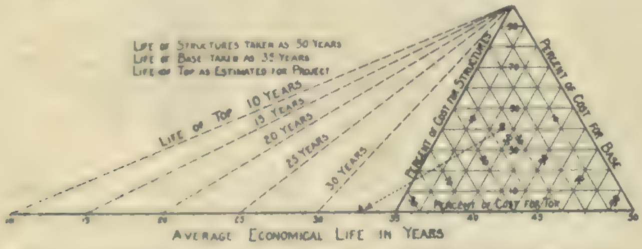

FIG 1. ECONOMICAL LIFE OF ROAD GOVERNING TERM OF BOND ISSUE OR INVESTMENT

The net annual saving in traffic operting costs is arrived at by deducting from the gross annual saving the increase in the annual highway budget for interest, maintenance and depreciation of the improvement. In order to obtain the annual cost chargeable to interest and depreciation it is necessary to estimate the economical life of the improvement contemplated and take that amount which at the end of the period will have discharged all interest and retired the principal.

Considerations which determine the economical life of the improvement, or the period beyond which it may no longer be maintained as such without prohibitive cost, involve not only a study of the durability of pavements of the various types but also the durability of the foundation and of such improvements as acquirement of right of way, reduction of grades, elimination of curves and grade crossings and installation of permanent structures, etc. If these latter features form a considerable portion of the first cost the term in which traffic saving is expected to pay for the project should be correspondingly lengthened. Some pavements may often be renewed at the end of their economical life without incurring any additional expense for foundation. To compare one type of pavement with another as to their durability the important point must not be overlooked that renewal may be extensive or merely the renewal of the surface. The most rational plan is to estimate first the durability and cost of structure etc., as Class I, foundation as Class II, and surface or wearing course as Class III and obtain a weighted average of durability for the entire project in which the factors would consist of the life and the per cent of cost of each class of improvement. Fig. 1. may be used in determining the economical life of the improvement. In this chart a life of 50 years is assumed for Class I, 35 years for Class II and from 10 to 30 years for Class III improvements. From the point at which the per cent of total cost lines for surface, base and structures intersect for a given project an imaginary

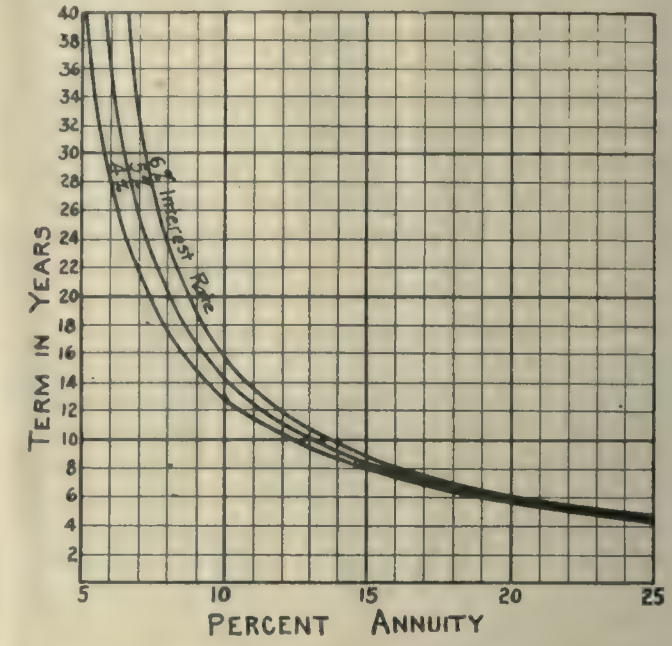

FIG. 2 PERCENT ANNUITY REQUIRED TO RETIRE AN INVESTMENT AT VARIOUS INTEREST RATES

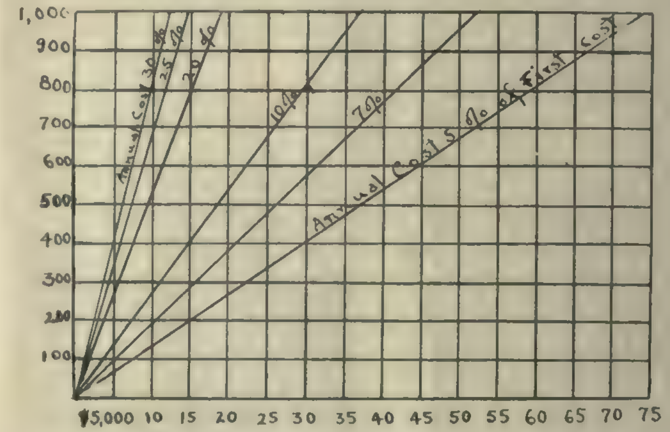

FIG. 3 JUSTIFIABLE FIRST COST OF ROAD PER MILE WITH SAVING OF 1 CT. PER TON MILE

(Concluded on Page 254)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

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Managing Editor

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI MAY 11, 1921 No. 19

Owing to the present printers' strike, a few numbers have been delayed in the date of issue.

Until October, 1919, "Good Roads" had been printed in New York City, but in that year was forced to open its publication office in Jamestown, N. Y., on account of the strike in New York City. Now, because of the unsettled condition in the printing field throughout the country, it has been decided to resume publication in New York City. While this action is causing annoying delay in getting out a few issues, the consolidation of offices will enable us in future to render a greatly increased service. We trust, therefore, that our readers will indulge us for the unavoidable delay.

REGULATING PEDESTRIAN TRAFFIC

An attempt to regulate pedestrian traffic has been made in Connecticut by the introduction in the Legislature of bills imposing a fine upon pedestrians for "willful neglect" in using the highways and providing that the left-hand side of the road be used at night. Note was made of these two measures in the issue of April 6.

It is presumed that these measures were introduced in all seriousness, but there has been some tendency to regard them as horse-play by some tired business man in the Legislature. One of our facetious correspondents, as was noted in last week's issue, has suggested the amendment of the first mentioned bill by adding to it a traffic code for pedestrians which went the rounds of the press some time ago.

As a matter of fact, there is a real need of some restriction of pedestrian traffic. Except for the ordinances against "jay walking" in some cities and the regulation of traffic at busy street intersections in the larger ones, there are no restraints upon the average person's proclivities for wandering at will over the highways, paying little or no attention to vehicular traffic. If the average motor vehicle operator were half as careless as the average pedestrian, he would soon lose both his license and his liberty. Scores of accidents are averted by a narrow margin for every one that happens, and when a car and a pedestrian are involved it is almost invariably the skill and care of the driver and not the pedestrian's efforts that prevent trouble. More pedestrians are saved from their own heedlessness by automobile drivers than are injured by them.

The wearing of head and tail lights by pedestrians is a bit too much to require, but a certain amount of restriction of foot traffic is entirely reasonable.

HOW THE RAILROADS SELL BONDS

Road officials of certain states who have been trying for many months to sell a few million dollars of road bonds, will regard with astonishment and wonder the news that $230,000,000 of railroad bonds were recently sold in three days. A banking syndicate headed by J. P. Morgan & Co. and the first National Bank of New York City opened the subscription books on April 28 for an issue of $230,000,000 of the Northern Pacific and Great Northern Railway Cos., and closed the books in three days.

Why should money be so readily available to the railroads when the states throughout the county are begging the bankers to buy road bonds so that road work may not be suspended? The great state of California has for several months been trying to dispose of $3,000,000 of road bonds. While it is true that the railroad bonds bear a higher interest than road bonds, it must be remembered that road bonds possess two distinct advantages over all private bonds. First, road bonds are safer than any private bonds and second, they are tax exempt. If the railroads are in such bad shape as they have continually claimed to be, one wonders how $230,000,000 of railroad bonds could be sold in three days.

Justifiable First Cost of Highways

(Continued from Page 252)

line is projected paralling the 10 year line if the surface is estimated at 10 years; the 20 year line if 20 years, or the 30 year line if 30 years. Intermediate ages can be plotted between these limits. The intersection of the projected line with the base gives the average economical life of the road or investment.

As an example, it is ascertained that Class I improvements represent 25%, Class II 35% and Class III 40% of the total cost of improvement. This point is located on the triaxial diagram at (a). If the estimated life of the wearing course is 20 years a line a-b should be drawn parallel with the 20 year line intersecting the base line at (b) which shows an average economical life of 32½ years for the road and also of the period in which the investment should be paid off.

As the cost of the improvement is logically expressed in the form of annual outlay for interest, depreciation and maintenance, Fig. 2 may conveniently be used to ascertain the annual per cent of first cost required for interest and depreciation over the period covering the economical life of the improvement. The curves are plotted to show interest rates of 4, 5 and 6%; ordinates show terms of years and the abscisses show per cents of total cost for combined annual interest and depreciation.

Maintenance costs may increase or decrease by reason of the improvement. Whatever the difference between the old and new costs may be, it should be taken into account by adding to or subtracting from the annuity determined by use of Fig. 2 as illustrated in the example which is given later.

The chart in Fig. 3. shows the justifiable first cost at a saving of 1 ct. per ton mile for any number of ton miles per day up to 1,000 for improvements estimated to require for interest, depreciation and maintenance 5%, 7,% 10%, 15%, 20% and 25% respectively of first cost.

To apply the chart, assume as an example an 800 average daily ton mi. traffic with a prospective saving of 1 ct. per ton mi. and that the engineer desires that the project be completely paid for in 32½ years. Reference to Fig. 2. shows that with interest at 5% the annual cost is 6.2% of the first cost for interest and retirement. The point on Fig. 3. for this latter per cent with a daily traffic of 800 ton mi. would give $47,000 as justifiable first cost. An adjustment may then be made for maintenance by turning to cost records of the old highway and ascertaining if the annual cost of maintenance is greater or less than that indicated by the estimated annual cost of maintenance for the improved highway. If, for example, the annual cost of maintaining the existing road is $800 per mi. and the estimated cost for the new road $300 per mi. an annual saving of $500 per mi. is indicated. Next should be ascertained what investment is justifiable on account of this saving for the same period and rate of interest previously decided upon. In other words $500 is equal to 6.2% of what sum? This is found to be about $8,000 which added to the $47,000 previously derived gives a total of $55,000 as justifiable first cost.

It may not be amiss to emphasize here the far reaching importance of saving in maintenance cost as justification for improvement in the highway. It is too generally the practice to charge to the improvement the full maintenance cost as well as the full interest on initial cost throughout the entire period.

The practice of proportioning outlay to traffic value of the project will become systematized in time. Preparation and design and selection of type in the light of obtainable traffic data can be made more definite and practical without curtailing the exercise of engineering construction judgment. Rather it will broaden the scope of the engineer. What is apparently needed is a blending of traffic and construction surveys to form a coordinated whole.

Suit to Test Arkansas Road Law

Taxpayers of the Wilmot Road District, Arkansas, have filed a suit in the Chancery Court of Ashley County to test the law under which the district was created. The taxpayers complain that the district has been burdened with a road debt of $1,343,859 which, reads the complaint, "is more than double the fair assessed value of the real property in the entire district". The complaint also charges that a bill passed by the legislature this year to compel the road commissioners of the district to make an accounting was stolen from the state archives before it could be enrolled and presented to the governor for his signature.

It is also alleged that a tract of land in Ashley County, the market value of which is estimated at $200, has been assessed $423 for roads, this tax being imposed without the consent of the taxpayer. It is further alleged that the district bonds were sold below par and that the bonds were made to bear interest "from a false date prior to the time they were issued".

New Hampshire Restricts Heavy Motor Traffic During Spring

State Highway Commissioner Frederick E. Everett of New Hampshire recently issued orders prohibiting traffic by motor vehicles exceeding 3 tons gross weight on state highways. This action was taken because the roads were soft while the frost was coming out of the ground. The order was to be withdrawn as soon as conditions permitted.

Current Highway Legislation-VII.

Revised Townsend Bill Introduced in Congress—Several States Pass Engineer Licensing Laws—Pennsylvania Increases Motor Vehicle Fees

(Continued from May 4)

It is of interest to note that Senator Townsend has modified his views in the past two years on the matter of federally constructed and maintained highways. The bill introduced by him two years ago provided for the construction and maintenance of a federal system of highways "entirely at the expense of the United States." In the bill introduced at the present session of Congress federal aid funds are to be expended in cooperation with the states.

Six states have passed engineers licensing laws this year and licensing bills are pending in other states.

United States

Senator Townsend has introduced a bill providing the creation of a federal highway commission to supercede the Bureau of Public Roads. The bill provides for an appropriation of $100,000,000 for each of the years 1921 and 1922, the states to meet these appropriations with similar amounts. An additional $15,000,000 is appropriated for roads within forest reserves. States having more than 5% of their total area in unappropriated public lands are not required to meet federal aid funds on a 50-50 basis, although the amount of funds allotted to such states remains unchanged. States are required to meet federal funds with state funds and must maintain federal aid roads with state money and not pass the burden to counties.

Representative Reese of Tennessee has introduced a bill providing for the transfer of additional war equipment to the states.

Arizona

A bill providing for the licensing of professional engineers was signed by the governor on March 19.

California

The Assembly Committee on Ways and means has reported out the following road bills: Trinity, Tehama and Shasta Highway, $75,000; Auburn, Placer, Sonora and Tuolumne Highway survey, $5,000; Vacaville Highway, sum unspecified; Butte-Willows Highway, sum unspecified; Alturus-New Pine Creek Highway, $80,000; Madera-Yosemite Highway, $50,000; Lassen County Highway, $40,000; Blythe-Mecca Highway, sum unspecified; Placerville-Coloma Highway, $100,000; Kings River Canyon Highway, $250,000.

Colorado

A bill providing for the licensing of professional engineers has been passed by both houses and signed by the governor.

Connecticut

The Committee on Roads, Bridges and Rivers is preparing a bill to raise motor vehicle fees. It has been tentatively decided to raise truck fees 100% and passenger vehicle fees 50%.

It is reported that a proposed $10,000,000 road bond issue is being discussed by state legislators and it is probable that a bill authorizing such may be introduced shortly.

Colorado

On April 4 the governor signed a bill providing for the licensing of professional engineers.

New Jersey

The bill providing for the licensing of professional engineers was signed by the governor.

North Carolina

A professional engineers licensing bill has been passed by the legislature and signed by the governor.

Ohio

A professional engineers licensing bill has been reported favorably by the Committee on State and Economic Betterment.

The bill providing for a state road commission to carry on the construction of a system of highways has passed both houses. The commission will consist of three members at salaries of $7,500 per year with terms of six years. The roads of the state are divided into two classes, state and county district roads. A companion bill providing for the issuance of $20,000,000 road bonds during the next two years, has not yet been passed by the legislature.

Pennsylvania

The Woodruff Bill providing for an increase in motor truck fees has been passed by the legislature and signed by the governor. The new fees are as follows: 1 and 1½-ton, $30; 2-ton, $40; 2½-ton, $50; 3-ton, $70; 3¾ ton, $100; 4¼-ton, $125; over 4¼-ton, $200. The fees for trucks equipped with pneumatic tires are approximately one-fourth less than the above fees.

West Virginia

The House has passed the bill providing for the creation of a state highway commission, amending the bill, which had passed the Senate, by authorizing the issuance of $15,000,000 of road bonds, instead of $20,000,000.

An engineers license bill has been introduced in the House.

(To be concluded)

Allegany County, Maryland, has fixed the following scale for road laborers for the year. Common laborer, 37.5 ct. per hour; foreman, 40 ct; team and driver, $6 per day; truck driver, $4 per day; road roller driver, $5 per day.

Road Work in Alabama

Although the work of the Alabama State Highway Department has been hampered by the decision declaring the state road bond issue invalid, contracts have been let for federal aid roads this year which involve an expenditure of $321,090. Federal aid projects under construction April 1 which are using federal, state and county funds involve 77.44 mi. of road and an expenditure of $698,515. Projects under construction at the same time in which only federal and state funds were being used involve 24.83 mi. of road and an expenditure of $283,737.

Firestone Offers College Scholarship For Best Good Roads Essay

The Highway and Highway Transport Education Committee of the U. S. Bureau of Education has announced that H. S. Firestone has offered another four-year college scholarship to the high school student who writes the best essay on Good Roads-Highway Transport. Last year the scholarship was won by Katherine F. Butterfield of Weiser, Idaho.

In the selection of the prize, the best local essays will be forwarded to the state committee and the best state essay forwarded to the national committee. The purpose of the contest is to acquaint high school students and their parents with the need of highway improvement and the economic value of good roads as aids in production and distribution.

Road Work in Maryland

The 1921 road program of Maryland calls for the construction of about 150 mi. of highway, according to John N. Mackall, Chairman of the State Roads Commission. Most of the sections to be improved are one to three miles in length, a few sections being 5 mi. long.

Missouri Legislative Roads Committee Visits Several States

The Missouri Legislative Roads Committee started on April 5 on a trip in which several states will be visited and information gathered on the administration, financing and construction of state highways. It is expected that a special session of the Legislature will be called shortly in the attempt to straighten out the Missouri road situation.

Wyoming Attempts to Build Roads Free from Snow Drifts

Wyoming is attempting to build roads which may be used throughout the entire year by maintaining the grade line at an elevation which will insure the roadbed being swept clean of snow. About half of the year in Wyoming there is likely to be snow, usually accompanied by wind. Any portion of the highway below the surface of the surrounding ground will drift full of snow. By building the grade at an elevation slightly above the surrounding ground, when possible, and above the brush or weeds which border the road, it is believed possible to have a road which will be free from snow.

New York Railroads Fail To Get Freight Rate Increase

The New York Public Service Commission, Second District, on April 7 issued an order denying about forty-five railroads operatng in the state an increase of 40% in freight rates on sand, gravel, crushed rock and other building materials. This action of the commission results from the activity of road builders in protesting against increased rates.

"Not only have the carriers failed to sustain the burden showing their right to the requested increases," said Commissioner Kellogg, "but the unreasonableness of the proposed increases appears conclusively on the record."

Tennessee Highway Contractors Organize

Highway contractors of Tennessee met at Nashville on March 28 and formed the Street and Highway division, Associated General Contractors of Tennessee. Addresses were made by Col. W. W. Howse, Chairman of the Tennessee Highway Commission, G. W. Buchholz, General Secretary of the Associated General Contractors of America, and others. John Thompson was made temporary chairman and Geo. W. Kilebrew, temporary secretary. Dues for active membership are placed at 1/8 of 1% on old contracts and 1/4 of 1% on new contracts, with a minimum of $100 per year.

Texas Given Year Extension to Meet Federal Aid

Texas has been given a year's extension in which to take up two federal aid apportionments, according to a recent announcement by the State Highway Department.

Lower Freight Rates in Michigan

The Michigan Public Utilities Commission recently ordered a reduction of 25% for the lower penisular and 22% for the upper peninsular in freight rates on intrastate shipments of sand, gravel and crushed stone. The order became effective May 10 and results from the vigorous fight road officials in the state have made against high freight rates.

New Jersey's Highway Program

New Jersey plans to build 65 mi. of state highways this year, according to a statement of T. J. Wasser, State Highway Engineer. Of this mileage, 52 mi. will be of reinforced concrete, 8.5 mi. of Warrenite, 4 mi. of sheet asphalt and 1 mi. of Topeka pavement.

Types of Pavements Build With Federal Aid

By **THOMAS H. MACDONALD***

The mileage of federal aid roads which have been built or are now under construction is nearly sufficient to encircle the globe. This is the record of work accomplished since July, 1916, when the Federal Government first stepped in to aid in the enormous task of building highways that are now called upon to carry more than 9,000,000 motor vehicles, plus a very substantial horse-drawn traffic in the 48 states. The Federal Aid Law is well named. The Department of Agriculture has given the broadest possible construction to the law for the purpose of providing the greatest mileage of highways suited to the traffic to be carried over them, at the minimum expense. An analysis of the projects under contract shows that all types of roads from the graded earth road up to the finest paved surfaces have been built.

On March 1 of this year, 22,030 mi. of highway, extending into every state, had been completed or were in process of construction, at a total estimated cost of $361,946,868. The percentage of this total estimated cost which will be incurred for each type, and the mileage of each type, based upon the records of plans approved, are as follows:

	Per cent of total estimated cost	Milege
Type 1. including earth, sand-clay and gravel	32.2	15,300
Type 2. including water-bound and bituminous macadam	9.0	1,530
Type 3. including brick, bituminous concrete Portland cement concrete	48.8	4,890
Miscellaneous	4.0	310
Bridges	6.0	
	100.0	22,030

The states initiate the road projects, but before federal aid is granted an engineer of the Federal Bureau of Public Roads makes an inspection of the roads to be improved, studies the local conditions, consults with the state highway department, and no projects are approved which are not considered suited to the conditions to be met. Many popular fallacies exist as to road improvement, and there have been many misconceptions as to the types of roads on which federal aid funds may be used. Properly built earth roads are the fundamental requirement in all highway improvement. Regardless of the material or type of surfacing which is to be placed, the preparation of the roadbed requires the highest engineering skill and experience. The department considers that the use of adequate sums for the securing of proper location, thorough drainage, permanent bridges and culverts, and the elimination of railroad crossings is demanded if enduring improvements are to result. Federal aid is allotted to the improvement of earth roads, but only with the stipulation that a suitable surfacing will be placed as soon as funds become available. This allows the roadbed to be prepared and become thoroughly consolidated before the surfacing is placed, which is highly desirable from a construction viewpoint. To follow such a course, however, is out of the question when a road is heavily traveled, and some form of surfacing must be provided. To care for traffic under these conditions, frequently a sand-clay or gravel surfacing is provided, which will serve for several years and yet allow the road to be maintained under reasonably heavy traffic.

Granting that the preparation of the roadbed has been properly done, many kinds of road surfaces will give excellent service. The element of time is important. There are so many miles of roads to be constructed, and their cost will be so enormous, that the most careful and detailed study of each road project must be made to provide, at the lowest possible cost, roads which will give satisfactory service and which can be maintained without undue depreciation under the traffic which is to use them. Many times the question has been asked the bureau; What type of road is best? The answer is always the same; There is no one best kind or type of road surface.

A recent statement issued by the officials of the Bureau expresses this thought in the following language:

"It is the policy of this bureau to consider the conditions on each individual federal aid project, as there are elements such as subgrade, drainage and present and prospective traffic, which vitally affect the determination of the standards of construction to be used."

That is, there must be a careful analysis both of the engineering and economic conditions for each particular case to determine the kinds of materials that can be used successfully, and after these facts are determined then the various types of construction which can be used economically should be brought into competition to secure the best possible results. There have been occasional attempts to write into state laws or the governing conditions of bond issues a requirement as to the type or kind of roads to be constructed. To follow such a course would be most unfortunate. The cost must always be considered in determining the type of road surfaces which are selected, and the allowable cost must be determined by the traffic which is to be borne. Local conditions vary to such an extent that very careful consideration must be given each project before determining the character or type of roads to be built. This principle was recently expressed to a

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*Chief, U. S. Bureau of Public Roads.

Chamber of Commerce asking for information, in the following language:

"Types of highways should not be specified by law. This is a matter to be decided by the state highway department in which should be lodged full authority both to construct and to maintain. Competition between different types of material should be maintained and selection made to fit traffic requirements in each case. The bureau does not recommend any one type to exclusion of others."

Report on Arkansas Road Situation

State Will Get No Further Federal Aid Unless Completed Roads Are Maintained

A report of the recent investigations of the Arkansas road situation by engineers of the Bureau of Public Roads, has been made to Thos. H. MacDonald, Chief of the bureau. The inquiry shows that the Government interests have been amply protected in every direction but that this has been done under many and increasing difficulties. Dealing with the question of taxation, it shows that road taxes in many instances are high and will become burdensome if the system of raising revenue through road improvement districts is continued. Arkansas is the only state using this system, which imposes upon the land in restricted areas the entire cost of improvements of general benefit to the state, while on the other hand the motor vehicle fees, relied upon in most states to supply a large part of the money required for road purposes, are much lower than in other states. Although no general confiscatory taxes have been found in districts receiving federal aid, many of the improvement district laws lack protective features which they should have and in consequence individual cases of inequitable assessments exist. One of the chief difficulties is the fact that non-uniform assessments of land for taxable purposes have in some cases been used as the basis of benefit assessments in the improvement districts.

The report goes on to show that the State Highway Department is not equipped with sufficient force or funds to carry on so large a road program as that planned for the state and that the administration of road matters by the state is open to serious criticism, especially the administration of some of the improvement districts.

While in a majority of the districts examined, the accounts and records of the commissioners were found to be in excellent condition, the investigators have found unexplained shortages in district accounts and improper charges of various kinds, including duplicate payments for the same legal services, payments to lawyers for securing federal and state aid and many cases of excessive overhead. In some districts important records have been lost, mislaid or carried away and in some cases practically no fiscal records exist except check stubs and deposit slips. Isolated cases of almost unaccountable engineering inefficiency are shown to exist and much of the difficulty with the road program in the state is attributed to poor administration by the State Highway Department and low grade engineering work.

The report closes with a group of conclusions in which it is recommended that no further progressive payments on federal aid projects be made in Arkansas until the existing conditions are corrected and that all payments be withheld until the completion of projects. Another recommendation is that the state be placed immediately on notice to maintain federal aid projects already completed. These recommendations have already been accepted by the Secretary of Agriculture, who, under date of April 30, in two letters notified the state of contemplated action by the Department of Agriculture. The seceretary points out that numerous projects have been suspended for lack of local funds, that in other cases payments of federal aid have had to be discontinued after being begun because of unacceptable work, and in still other instances payments have never been made on projects in course of construction because no work so far done has been satisfactory. He continues:

"Since this department is vested with the administration of the Federal Aid Road Act and the control of the expenditure of the funds apportioned thereunder to the several states, it is incumbent upon it to safeguard as far as possible the expenditure of the funds to insure that a proper return in the form of improvement of highways is obtained for each dollar expended. In line with this, I feel that this department can not consistently agree to make progress payments on any more federal aid projects in the future. I, therefore, wish to advise you that hereafter project agreements to cover Arkansas projects will provide for payment of federal funds only on completion of the project, until such time as the conditions with reference to the projects enumerated herein are corrected and satisfactory provision made for adequate engineering, supervision, and inspection on federal aid projects."

Referring further to maintenance of completed projects which have been allowed to go uncared for the Secretary calls attention to five separate projects which are in such condition that he considers it necessary to notify the state that their duty to maintain as required by the Federal Aid Road Act is not being met, and after quoting the law says:

"It is regarded by this department as particularly unfortunate that the federal aid projects enumerated above should have been neglected and not kept in a proper condition of maintenance. Since this unfortunate condition has been allowed to obtain, however, there is no alternative left to this department but to act pursuant to the authority conferred by Sec. 7 of the Federal Aid Road Act. You, therefore, are hereby notified that it is found that the projects herein named are not being properly maintained, and that unless within four months from the date of receipt of this notice said projects shall be found to have been put in a proper condition of maintenance I will thereafter refuse to approve any project for road construction in the State of Arkansas, until such time as the projects in question shall have been put in a proper condition of maintenance."

The legal advisors of the Department of Agriculture say that the State Highway Department is in a position to do a great deal toward correcting the administration of federal aid in the state both with respect to construction and maintenance, if it is so disposed; and it is believed that the course taken by the Secretary of Agriculture will make it necessary for the state to take such action without delay if it is to continue to enjoy the advantages of federal aid.

Bridge in Georgia Burns

A bridge across the Potato Creek, Upson County, Georgia, was completely burned on April 9, catching fire from a burning strip of woods nearby. The bridge, being of wood, was quickly consumed. Traffic is detoured several miles.

EQUIPMENT—TRADE—MATERIALS

Koehring Issues Book on Concrete

A book which should prove of immense value to those engaged in concrete construction work has been issued by the Koehring Company, Milwaukee, Wis. This book is of pocket size, cloth bound and contains over two hundred pages of practical information on the placing of concrete in roads, bridges and other structures. Among the chapter headings are: Forms for Concrete Construction: Estimating Cost of Concrete Construction; Concrete in Highway Construction; Convenient Estimating Tables and Examples of Use; Notes on Bridge and Culvert Construction.

Iroquois Asphalt Mixing Plants

A booklet describing the Iroquois line of asphalt mixing plants has recently been issued by the Barber Asphalt Paving Company, Philadelphia, Pa. The portable and stationary types are described and illustrated. In the back of the booklet is given a list of some of the users of Iroquois asphalt plants, among which are New York City, Philadelphia, Roanoke, Va., Oklahoma City, Okla., Johnstown, Pa. This booklet is known as bulletin No. 2B.

Tractor Companies Consolidate

The Post Tractor Company of Cleveland, O., and the Whitney Tractor Company of Upper Sandusky, O., have consolidated to form the Post-Whitney Tractor Company, with general offices in Cleveland. The capitalization of the new company is $10,000,000. E. B. Cassatt is president and F. R. LePage, secretary. C. E. Grove has been appointed sales manager.

Rosoff Engineering Company Buys Cement and Gravel Plants

The Rosoff Engineering Co. of New York City purchased the Alsen Cement Co. and the Marlborough Sand and Gravel Corporation at a public auction on April 20, at Catskill, N. Y. The price bid for the cement works was $500,000 and the price bid for the sand and gravel company was $301,000. The Rosoff Engineering Co has a number of road contracts in New York State.

Road Work in North Carolina

Eight counties have agreed to build sections of state highways with their own funds, to be reimbursed later by the state.

Road work actually under construction in North Carolina involves an expenditure of approximately $9,750,000. This work includes 550 mi. of gravel and 107 mi. of hard-surfaced roads and two bridges.

The Pompton Lakes, N. J. Borough Council has sent a protest to the Passaic County Board of Freeholders, complaining that the abutments of the Lakeside Avenue Bridge are in dangerous condition and in need of immediate repair.

The Vulcanite Portland Cement Co. has moved its New York office to the Borden Bldg., 350 Madison Ave.

In Philadelphia, Pa., 654 automobiles valued at $1,139,241 were stolen since Jan. 1. Of this number 201 cars have not been recovered.

The County Commissioners' Court of Dallas County, Texas, has authorized the sale of $2,700,000 of District No. 1 road bonds to take care of the remainder of the 1921 program. This issue will bear 5½% interest, ½% higher than the interest on the last bonds sold.

An 80-ft. iron bridge near Muscatine, Ia., has collapsed because of the failure of an abutment built on unstable foundation. Traffic is detoured.

The Municipal Council of Paris, France, has suggested the construction of "Thank you ma'ams" at street crossings which will compel automobiles to slow down. Automobilists are protesting this scheme.

The City of Wilmington, Del., has passed an ordinance providing for a $450,000 street bond issue. It is planned to pave a number of streets with the proceeds of the bond issue.

MEETINGS

Calendar of Coming Meetings

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

June 20-24—American Society for Testing Materials—Twenty-fourth annual meeting, Asbury Park, N. J. Secretary, C. L. Warwick, Engineer's Club Bldg., Philadelphia, Pa.

Highway Conference at Yale

A conference on highway traffic regulation will be held at Yale University on May 23 in cooperation with the Committee on Highway and Highway Transport Education of the U. S. Bureau of Education. Among the speakers will be C. J. Tilden, Director of the committee; A. N. Johnson, Dean of the Engineering Department of the University of Maryland; J. W. Inches, Police Commissioner of Detroit, Mich., and C. J. Bennett, State Highway Commissioner of Connecticut.

American Society for Testing Materials

The twenty-fourth annual meeting of the American Society for Testing Materials will be held on June 20-24 in Asbury Park, N. J. The fifth session, on Wednesday evening, June 22, will be devoted to road materials and concrete aggregates. At this session the following papers and reports will be presented: Report of Committee D-4, On Roads and Paving Materials, A. H. Blanchard, Chairman; "The Measurement of Impact," by E. B. Smith; "Tests for Soils with Relation to their Use in the Subgrade of Highways", by A. T. Goldbeck and F. H. Jackson; Report of Committee C-9, On Concrete and Concrete Aggregates, Sanford E. Thompson, Chairman; "A Study of the Composition of Slags Suitable for Concrete Aggregates," by L. G. Carmick.

PERSONAL MENTION

W. E. Moss has been appointed city engineer of Mt. Vernon, Wash.

H. P. Shoemaker has resigned as city engineer of Lock Haven, Pa., to enter private practise.

I. Paul Jones has been appointed acting secretary of the Delaware State Highway Commission.

Harry W. Perry has resigned as secretary of the Trailer Manufacturers' Associations.

L. G. Meldram has been appointed secretary of the Trailer Manufacturers' Association. For a number of years Mr. Meldram has been abroad as foreign representative of automotive interests.

George W. Francis has resigned as secretary of the Delaware State Highway Commission.

Bruce Aldrich has resigned as district engineer in charge of the Toronto, Canada, office of the Asphalt Association and is now with Kilmer M. Barber, Ltd., Toronto.

Thomas McEwen has been appointed highway superintendent of Maury County, Tennessee.

B. L. Taylor, formerly engineer of Woodbury County, Iowa, has opened an office in Sioux City for private practise.

L. H. Wright has resigned as director of the Indiana State Highway Commission.

PUBLICATION

A STUDY OF THE CALIFORNIA HIGHWAY SYSTEM. Report by the United States Bureau of Public Roads. Cloth, 9x12 in. 277 pages, 145 charts, maps, etc.

The investigation of the California state highway system as reported in this book, was undertaken by the U. S. Bureau of Public Roads by request of the California State Highway Commission and is the most scientific and thorough investigation of a state system of roads ever undertaken. Motor organizations of California agitated the state by declaring that the policies of the commission were unwise and the roads being constructed were unequal to meet traffic demands. This report shows such charges to be false and in general upholds the policies of the commission.

Planking on a bridge in Gloucester County, New Jersey, was ripped up and stolen recently. A few weeks before lumber intended for bridge work in another part of the county was stolen in the night. Last year an entire bridge over a small stream in the northeastern part of the county was stolen and carted away shortly after being finished.

Governor Hardee of Florida, in his first message to the Legislature on April 5, recommended the continuance of the 2-mill road tax and an increase in the tax on gasoline and oils. The governor also pointed out the fact that the state had no bonded indebtedness.

Some Highway Engineers in France find that it pays to be married. The French Government increases the salary of a married highway engineer $63 monthly for each of the first two children; $87 on the arrival of the third and a flat rate of $93 each for all following arrivals.

Alaska Spent $765,000, in 1919 and 1920, on road work under the Cooperate Road Act passed by the 1919 Alaska Legislature, according to a report of the Territorial Board of Road Commissioners.

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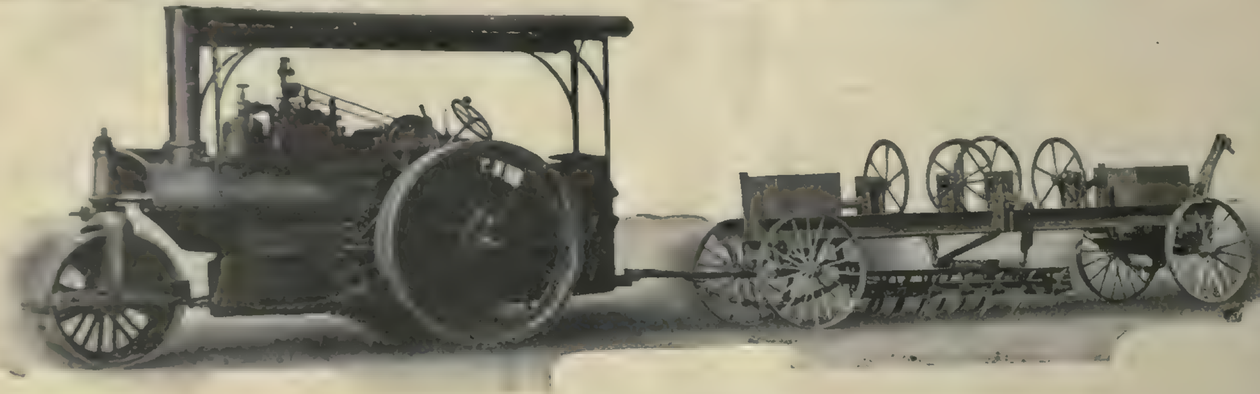

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Old Series, Vol. LX
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JAMESTOWN, N. Y., MAY 18, 1921

Number
20

Refined Tar In Construction and Maintenance*

By PHILIP P. SHARPLES†

Few who have not studied the matter are aware of the large sums of money that can be profitably spent upon our old roads at the present time, rather than to replace them with new construction. The higher types of roads are now costing $30,000 to $50,000 per mile for the road top alone. The interest on these amounts will yield a fund of $1,500 to $2,500 per mile per year which could be spent in maintaining a present road rather than replacing it. To this interest should also be added the refunding charges on the new road which, with a probable life of 20 years for the road, would yield another similar sum. In addition, there is the maintenance of the improved road which could hardly be expected to be less than $500 per mile per year, through a long period of years. The total gives the sum of $3,500 to $5,000 per mile per year, which can be spent in reviving or maintaining an existing road rather than to replace it.

The same sort of comparison can be drawn between the high cost type of construction and a low cost type of construction. As types, we can mention gravel roads at $5,000 to $6,000 per mile; macadam with surface treatments at $15,000 to $20,000 per mile; concrete at $30,000 to $50,000 per mile, and bituminous top on concrete base, at about the same price.

The use of tar materials for surface treatment of macadam roads began in France in 1901 and soon spread to England and the United States. Their use in Canada followed in 1908 with some experiments at Toronto. The early materials were of such viscosity that it was necessary to apply them hot. Rather crude methods were used, but even at that, the results were rather surprising. One of the earliest roads treated was in the vicinity of Boston, Mass., the Metropolitan Parkway, north of Boston. This had been maintained up to the present time with

LADY GREY ROAD, OTTAWA, CANADA—PENETRATION MACADAM WITH REFINED TAR.

BRANT ROAD, GALT, CANADA—TAR PENETRATION MACADAM BUILT IN 1911.

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*Paper presented at eighth annual convention, Canadian Good Roads Association, Halifax, Canada, May 10-12.

†Manager, General Tarvia Dept., The Barrett Co., New York, N. Y.

the same grade of material and has through all these years been in most excellent condition. The yearly cost has been only a few cents per yard per year. When it is realized the extremely heavy auto traffic that this road takes, often amounting to thousands of vehicles per day, it is quite gratifying to know that a road can be kept in such good condition at so little cost.

About 1907 there was developed a new coal tar material for surface treatment which had the great merit of being applicable without heating. This solves many troublesome problems and also very much lowers the cost of surface treating macadam highways. The method has been very widely adopted and where macadam highways are in good condition, it has proved far the cheapest method of maintaining the roadways. Only small amounts per square yard are used in yearly treatments; generally, ⅓ gal. Imperial, the first year and 1/5 gal. Imperial, or less, in subsequent years.

These treatments require lighter cover than the hot surface treatments, and in some cases where the traffic may be blocked off from the road, the cover may be dispensed with altogether.

These surface treatments coupled with repair work done with cold patching materials, give a system of repair and maintenance for macadam roads that has enabled them to carry heavy automobile traffic successfully. In Canada the treatments are used on roads like the York County System, and the King Edward Highway. The material is also most excellent for maintaining any bituminous type of roads. Experiments have been tried for a number of years in the application of the method to gravel roads. Gratifying results have been obtained on gravel roads that were firm and hard and in good condition. In Maine, the trunk highway from Kittery to Portland has 26 mi. of gravel road, part of which have been maintained by this method for nine years. While the cost has not been inconsiderable, amounting to $500 or $600 per mile per year, it has nevertheless given a surface that takes very heavy traffic in the summertime, 3,000 to 5,000 automobiles per day, and gives a surface free from dust and mud that is entirely satisfactory to the summer traffic.

Experiments have been tried in New Hampshire and Massachusetts to develop a method of building gravel roads in such a way that the cold refined tar may be applied to the surface immediately after construction rather than waiting for the gravel road to season in the regular way. Applications of about one gallon per square yard, with proper construction and proper maintenance have produced very interesting results. There is a field here for further experimenting, but the data already obtained points the way for the development of a road of a little higher type than the ordinary gravel road which would be of great economic advantage in localities where good road building gravels are plentiful. It must be remembered, however, in considering any gravel road problem, that gravels differ greatly even in relatively small areas and that it is only certain types of gravels that seem to be suitable for bituminous treatment.

Refined tars have proved especially valuable in strengthening the macadam form of construction. The wear on a plain macadam pavement takes place not only from the abrasion of the stone on the surface, but also through the abrasion of the stone within the body of the road. This interstitial wear is brought about by the grinding of the stone together under the weight of traffic. It may be almost entirely eliminated by the application of the proper grade of refined tar cement to the stone of the macadam during construction by what is called the penetration method. The base is prepared as for any good road, with the proper precautions in regard to drainage and foundation. This base should be built as well as for an ordinary plain waterbound macadam road, and should be thoroughly consolidated before the bituminous top is built. The stone for the bituminous top must be clean and of good quality. The usual depth of the bituminous top is 2½ in. when finished. The great secret in successful work is to so roll this layer of stone that it will be in condition to properly receive the refined tar. The stone must be open enough to let the tar into the road and yet to give the strongest type of construction, it should be locked together. Not every stone will furnish these conditions and for that reason some study is required in order to produce the best results with any given stone. The quantities of material have, in the course of time, been fairly correctly determined, although these will vary somewhat with stone conditions; usually 1¼ to 1½ gal. Imperial for the first coat and ⅓ gal to ½ gal. for the seal coat, has given the best results on a 2½ in. top. It is also usual nowadays, where the road is subjected to much traffic to put on a further seal coat of cold refined tar. This seeks out the weak places in the pavement and insures a waterproof and homogeneous surface. Roads constructed by these methods, have proved not only of reasonable first cost, but of very low maintenance cost.

In Canada, there have been some noteworthy examples of early construction. Of these may be mentioned the approach to the Victoria Docks in Montreal, the excellent work in Mount Pleasant Cemetery, Toronto, and the work in various Ontario cities, like Kitchener, Stratford and Ottawa. In the Maritime Provinces, good examples may be seen on the Rothsay Road, outside of St. John, and more recently, the Bedford Road in the City of Halifax and between Halifax and Bedford. This road is not yet completed and construction is now going on, furnishing a good exhibit of the methods of building this type of pavement.

The present tendency in maintenance and repair work is to follow the lines laid down in the best French and English practice and to take care of the road by the patrol system, or its modified form called the gang system. These methods are applicable to all types of roads, but in the case of bituminous treated and bituminous roads, the system has received a great impetus through the perfection of bituminous repair materials which may be used cold. Coal tar binder is cut back with a solvent, so that after use in the road, the solvent evaporates, leaving an excellent binder in the stone. In the case of patrolmen, or patrol gangs, the men are furnished with the cold patching material which they use at discretion in repairing breaks in the surface, or even in renewing entire sections of the roads. In city and town work, it is now customary to supply the stone coated with the cold patching material from a central point where small concrete mixers are used to prepare the batches. By mixing the material on rainy days and using it on pleasant days, a very economical upkeep is assured. If these cold patching methods are thoroughly carried out, astonishing results may be obtained in repair and maintenance work. The City of Somerville, Mass., for instance, has a large mileage of macadam and bituminous macadam roads which are now all surface treated with bituminous material. These roads are kept in top-notch condition at all times by the use of cold repair materials. No break in the surface is allowed to remain for more than a few hours after it is known to the street department. A very perfect system of reporting holes has been built up through the police department and through the foreman of the street department. The system has not only proved a great boon to the users of the road but has, as well, proved very economical.

With changing traffic conditions, these methods are even more applicable at the present time than they ever have been before. With the practical elimination of horse traffic in many sections of the country, the bituminous surface treatments are now enduring in places where they were not previously very satisfactory due to the stripping power of horses' shoes and steel tires.

Rebuilding Gravel And Macadam Roads *

By E. A. JAMES†

The subject of this paper implies that building and rebuilding roads are different operations. Too frequently road builders do not recognize this difference, and as a result, much valuable road material is hauled to the dump, and money invested in former road work lost because roads are being built where rebuilding is all that is necessary. The use of the word "rebuilding" suggests that the roads formerly built require rebuilding since, because of improper maintenance or increased weight and volume of traffic, they are not now sufficient to carry the loads imposed.

Until a few years ago, road builders were without a standard for loads on the highway, the limit of the load being the capacity of the bridges. In some cases this meant a ton load, and in others a 20-ton load. Under such conditions, uniformity in road construction was not to be expected.

The first attempt made in Canada to definitely regulate the weight of vehicles on highways, and thus standardize road building, was a bill introduced by the Hon. Geo. S. Henry in the Ontario Legislature in 1915. It was reintroduced in 1916 and that year became the law of the province. The Load of Vehicles Act limits the weight of vehicles operating on the highway and their loads to 12½ tons, or 4½ ton on any one wheel, which wheel must not impose a greater dead load than 650 lb. per inch of tire. Since the passing of this act, road builders of the Province of Ontario have had before them a definite standard to which to build, for having regard to the weather conditions of all seasons, it is found that the weight of vehicles rather than the volume of traffic is the factor that governs the type of road required. One 10-ton truck operating at 10 mi. per hour will impose a greater strain on the pavement than ten 1-ton trucks operating at 10 mi. per hour, under the conditions that prevail on rural roads in spring and fall.

Drainage

Other papers deal with the question of drainage, but one cannot discuss the question of road rebuilding without a paragraph on road drainage. The load carrying capacity of any type of pavement must, of necessity, bear a definite relation to the support afforded by the subgrade. Most subgrades consist of soils with various percentages of moisture, and their maximum carrying capacity depends upon the removal of the maximum amount of moisture. This may be done sometimes by deep side ditches, sometimes by tile underdraining; oftener by a combination of both these methods.

In rebuilding roads, the first study should be for the purpose of ascertaining whether provision has been made for drainage.

The object should be to prevent water from gathering under the roadbed rather than to remove it af-

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*Paper presented at eighth annual convention of the Canadian Good Roads Association, May 10-12. Halifax, Canada.

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terwards, so cut-off ditches and cut-off drains should be the type used in road rebuilding.

When it is suggested that a gravel road be rebuilt, those responsible must have decided that a gravel road properly built and properly maintained is sufficient for the traffic on that highway; otherwise to rebuild it would be unwise, as the conditions manifestly require a superior type of pavement.

In rebuilding a gravel road, one should first ascertain the depth of the metal remaining upon the roadway. When in possession of this information, the road builder will be able to decide whether it will be less expensive to reshape the road by adding new material, or by scarifying and grading the gravel now upon the roadway to the proper cross section. Frequently gravel roads are rebuilt by adding new material until the roadway is higher than the road berms, when as a matter of fact there was sufficient material in the roadway had that material been properly used.

For scarifying gravel roadways preparatory to reshaping, the road machinery companies are manufacturing a scarifier bar which may be attached to the usual No. 6 or No. 8 road grader. This scarifier will loosen a strip of gravel 8 ft. wide and 2 in. deep at the rate of 2 mi. per hour. The road thus loosened should then be harrowed lightly so as to thoroughly mix it; the pockets should be shaped with a road grader; and, after every shower, it should be dragged.

If, however, there is not sufficient or suitable gravel, and new metal is to be added, the road should be shaped and the new material applied in layers of not more than 4 in. at a time, and the work should be carried forward in such a manner that the teams will draw over the loose gravel, each load drawn to the work assisting in binding the former load. It may be necessary at times to wet the road with the aid of sprinkling carts and thus hasten the binding process, which is almost impossible without moisture. After sufficient gravel has been added, the road should be dragged following rain until under the traffic it is well bound.

In rebuilding a gravel road for traffic up to 4-ton loads, 8 in. should be the minimum thickness of metal, and for 6-ton loads, 12 in. If the loading is to be heavier, a higher type of road should be used. The road should be rebuilt with a crown of ½ in. per foot of width, and in the reshaping this should be reduced to two-thirds of the amount.

If the character of the material and the character of the traffic warrant rolling, the gravel should be sprinkled with water and rolled with a self-propelled, grooved road roller, weighing approximately 10 tons.

Gravel For Rebuilding

It is just as necessary that the material for rebuilding be carefully selected as the method of rebuilding. The gravel used should be composed of hard, durable material, and with the proper proportion of fine material, sufficient, but not more than sufficient to fill all the voids. All stones that will not pass a 2 in. ring should be removed.

In selecting material for gravel road rebuilding, we have a choice of two types of gravel. First, those gravels which have to be crushed and screened. This is far the better type of material, as many angular pieces assist in wedging and binding the gravel bed. Also, in these gravels the road builder controls the proportion of fine and course material, thus securing the ideal mix. Second, pit-run gravel. Often the pit-run material makes good roads when properly applied, but just as often clay and loam in excess exist, or the fine and coarse material is not properly graded.

Rebuilding Macadam Roads

Where gravel roads have failed because of the volume or weight of traffic, it has been the custom to attempt to take care of the traffic conditions by building water-bound macadam highways. In the earlier days of road building, the mistake was made of attempting too many miles of road without sufficient width or thickness of metal. The result has been that miles of water-bound macadam roadways became expensive of upkeep and, under certain weather conditions, unable to carry the traffic. In some instances the macadam has been ripped up and used for fill, and in its place concrete and bituminous pavements have been laid. In many cases this has been a waste, as with proper reconstruction the material in the old road could have been made to do good service in the new. I have in mind a water-bound macadam road that was built in 1911, the finished road being 5 in. thick and 9 ft. wide. By 1919 the traffic had so increased that it was unprofitable to continue maintenance, and it was decided to rebuild. When the road was first built, the subgrade and drainage was properly provided for, so that it was not necessary for these purposes to disturb the old macadam. The road was graded on each side of the old macadam 8½ ft. and the edges of the old macadam scarified with a power scarifier. A base course of water-bound macadam was then built 5½ ft. on each side of the old base, thus giving a new base 20 ft. wide. Over this new base there was then constructed a water-bound macadam top of an average thickness of 5 in. The water-bound macadam was then treated with 1/5 gal. of bituminous material per square yard, and without further treatment this road has been carrying 240 motor cars and 40 motor trucks per day. The road was given a similar treatment in 1920, and today you will not find three holes in a mile of road.

Another water-bound road built 11 ft. wide and 6 in. thick in 1912, was not in 1920 sufficiently heavy to carry the traffic. The base course was rebuilt to the widths and depths referred to in the former ex-

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GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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THE RAILROADS AND GOOD ROADS

Declaring to the Senate Interstate Commerce Committee that motor transportation is working an injury to the railroads, Julius Kruttschnitt, Chairman of the Board of Directors of the Southern Pacific Railroad, gives voice to an opinion held by many railroad officials. Last summer Daniel Willard, President of the Baltimore and Ohio Railroad, proposed the suspension of road work through the withdrawal of road labor to the farms. Hence, there would seem to be reason for believing that railroad officials in general do not look with favor upon highway and motor transportation development.

Whatever may be the causes of the alleged pitiful condition of the railroads—although $230,000,000 of railroad bonds were recently sold in three days—the attempt to lay even a small part of the blame on motor transportation is foolish. In the first place, the motor truck is able to transport short-haul freight more cheaply and speedily than the railroads. In the second place, the motor truck opens up new fields, enabling the marketing of commodities formerly either not produced or, if produced, not marketed. In the third place, the motor truck today is the greatest feeder of the railroad and furthermore, will form a part of the railroad equipment in the coming store-door delivery system.

It is estimated that the motor truck is already hauling one-half as much tonnage as are the railroads. Ten years hence the motor truck will be hauling a greater total tonnage than will the railroads. Transportation is now in a period of transition, a period of development. Railroad officials, instead of bewailing the progress of highway development and motor transportation, should read the writing on the wall—that the proper coordination of the railroad and the motor truck presents a great opportunity for them.

OUTLOOK FOR MORE FEDERAL AID

In highway legislation introduced at this session of Congress is seen the coalescence of aims of highway factions. The new Townsend Bill accepts the present plan of federal aid to states, although retaining the provision for the creation of a federal highway commission to administer the law. Thus is the federal aid plan now generally recognized as sound in principle. The Dowell Bill, drafted by the American Association of State Highway Officials, is an especially constructive piece of highway legislation. It provides, among other things, for the development of a national system of highways and for the maintenance of federal aid roads by the states with state funds, thus removing the shortcomings of the present law.

There is no question but that the present administration of the Federal Aid Law by the U. S. Bureau of Public Roads is efficient and satisfactory. The creation of a federal highway commission would probably increase the personnel and would undoubtedly introduce difficulties in the selection of roads for improvement. And since there exists considerable opposition in Congress toward further ramification of administrative departments it seems at present that the Townsend Bill is not likely to prove acceptable. The Dowell Bill, on the other hand, has well-wrought provisions which appear to adequately cover the administration of federal funds in building a national system of highways.

HIGHWAY ECONOMICS

Considerable attention and thought is now being given to the economics of road building. This is due in part to the rapid increase in highway costs during the war; but it is also a natural sequence of the general voting of immense bond issues throughout the country. With the spending of millions of dollars for highway improvement, it is but natural that the question will arise in the minds of many, "Are we spending our funds so as to get the greatest possible returns on our investment?"

It must be confessed that the economics of road building has not received sufficient attention in the past; first, because highway engineers have been busily engaged in solving the technical problems of construction and maintenance, and second, data have been limited upon which to base economic deductions.

However, with the increasing problems in road building, such as that many communities are now approaching their limit of bonded indebtedness, the problem of getting the most return from road funds becomes more and more important.

The economic factors which are to be considered in the study of a road improvement are many, as, methods of financing the improvement, cost of construction, life of the pavement, traffic, maintenance cost, and the reduction of the operating costs of vehicles. For example, because of high interest rates now prevailing, approximately 10% has been added to the cost of road construction in the last few years by this factor alone.

The problem of making limited highway funds bring the greatest good to the greatest number, confronts every road official who plans highway improvements.

In last week's issue an article was published which attempted to establish mathematical relations between costs and service returns of pavements as determining justifiable first costs of pavements. In this issue is printed an article which discusses the adaptation of macadam and gravel roads to traffic of the present day. Both of these articles emphasize the importance of the study of highway economics in planning road improvements.

THE MOTOR VEHICLE AND GOOD ROADS

Aside from showing the beginnings of highway development in Brazil, the article on Brazilian roads appearing in the last week's issue is of interest in that it shows that the history of highway development in the United States is being repeated in other countries of the world. As the motor vehicle grows to be an important part of the transportation system of a country, the desire for better highways springs forth. The Santos-Sao Paulo Road in Brazil is a direct result of the growing use of automobiles in that country. As the number of motor vehicles increases other roads will be improved, until finally the country will have a system of modern highways. In Japan, Australia and other countries may be seen similar good roads movements being stimulated by the use of the automobile.

Sand and Gravel Production in 1920

The total quantity of sand and gravel produced in 1920 was nearly 78,000,000 tons, or about 7,000,000 tons more than in 1919. The total value increased from about $46,000,000 to more than $62,000,000.

The City of Norfolk, Neb., plans to spend $200,000 on street paving this year.

Rebuilding Gravel and Macadam Roads

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ample, and the whole topped with a 3 in. bituminous penetration macadam top. This top was built of 2-in. stone, into which 1 ½ Imperial gallons of bitumen were forced. Half-inch stone chips were then added and rolled. The surface was then sealed with ½ gal. of bituminous binder, covered with ⅜-in. stone and again rolled. This surface today has all the appearance of a mixed pavement, and frequently carries 200 motor cars per hour, and in addition many heavy trucks.

A third water-bound road was built in 1911, and in 1920 required rebuilding. The same methods and dimensions were used in rebuilding the base as in former examples, there was then added a 2-in. course of 1-in. stone, water-bound, and the whole topped with a Topeka mix asphalt. This road is carrying the heaviest traffic out of Toronto today, and is very similar to the type of pavement now being successfully built on the Ontario provincial highways.

These three examples suffice to show that macadam roads can be successfully rebuilt without loosing the first investment. The light and narrow macadam gave service for years, and was then used to form the major part of the new base, which new base will carry the kind of top required for new traffic conditions.

This rebuilding must provide a base course of 7 in. of consolidated stone and a wearing surface of 3 in., consolidated, for penetration, or 2 or 3 in., consolidated, for mixed surfaces.

In rebuilding roads, remember that the salvage will reduce costs in road building just as in house building and that a road rebuilt is often more substantial than a new road, because you have the consolidation of the base due to years of traffic.

Railroad Official Would Curb Motor Transportation

At a hearing of the Senate Interstate Commerce Committee on May 10, Julius Kruttschnitt, Chairman of the Board of Directors of the Southern Pacific Railroad, urged the placing of restrictions on the use of highways and waterways so as to divert traffic to the railroads. Mr. Kruttschnitt urged "adequate tolls" on highways built with public funds; "adequate tolls" on public inland waterways; that the Government "stop the lavish expenditure of public money to provide coast-to-coast ocean transportation in competition with transcontinental railroads"; "adequate tolls" for the use of the Panama Canal.

HIGHWAY TRANSPORTATION

Highway Transport Clearing Houses*

As chairman of this committee I have made many inquires as to just what should be the function of a highway transport clearing house, or what should be the complete character of service rendered by a highway transport freight station. My inquiries covered a wide field of motor transport activity, and the answers were as varied in definition as the number of inquiries made.

It is perhaps not unusual that, as yet, there should be no clear, well defined point of view on either of these questions, as experience, the great teacher, has had little opportunity of working out these important factors of motor transport application.

I am convinced, however, as a result of these inquiries and their answers and as a result of my own experience in motor transport, that a motor truck terminal and clearing house is as essential to successful motor transport, as freight terminals and clearing houses are to steel rail or water transportation.

The theory that all shipments to be transported by motor truck can be picked up at the shipper's platform by the transport truck, and that the highway transport truck can also deliver to store door, or be successfully applied as a cartage vehicle, must be given up.

This statement may excite considerable opposition, because so much has been written and said about the motor truck rendering a service direct from shipper to consignee and that because of such service unnecessary handling of freight has been saved, which is all true, but which will be the special or rare case when motor transport is broadly applied as a definite link in the whole service of transportation.

I know of no important industrial center in America from which, within the next six years, less than 8 different motor transport routes will be operated, and from some centers this number may be increased to 20 or 30.

It would be a daily occurrence for some shippers to have consignments for each of these routes, and limited platform space, which has long been a menace to American industry, would prevent the transport truck from each of these routes picking up their route consignments at shipper's platform.

Many shippers in Indianapolis, Cleveland, Cincinnati, Louisville, Chicago, Milwaukee and other centers who now have access to the better short-haul motor transport service will not use it because of their limited platform space.

Many shippers have said to me that they would gladly use motor transport for all short-haul consignments if their shipping department could load to their own freight delivering vehicles, to be dropped off at motor transport terminal while making daily deliveries to all other terminals.

There are four definitely fixed reasons why motor transport freight stations and clearing houses are essential to successful motor transport operation.

1. Limited shipper's platform space, which is too often inadequate to serve his own demands.

2. Most large shippers maintain regular cartage equipment which makes regular daily trips to steam, electric, and water transport terminals, and could add consignments to motor transport terminals at less cost than transport trucks could pick up, providing, however, truck terminals would be properly located. This applies to the endless number of small consignments, which makes up the major portion of tonnage for all short-haul shipments. When full truck load or even a comparatively large consignment for highway transport is made, a clearing house record on cost of cartage should determine when it is most economical for the transport truck to pick up at shipper's platform.

3. Until highways will sustain tonnage and permit speed in motor transport, it is economically necessary that this mode of transportation confine itself to the service of transporting the higher class of commodities. The motor truck renders an express service plus, not only through a motor truck terminal and clearing house can highway transport schedules be established and maintained or sufficient tonnage in express, first and second class freight secured to make it a real factor in transportation.

4. Generally speaking, motor transport is as yet an indefinite thing. It lacks substantiality, responsibility, dependability, the general shipper can not accept it as a definite phase of transportation as he has accepted the railroad. A public motor transport terminal and clearing house is a gateway to and from all highways, it will supply that definite point of contact which highway transport now lacks, it will indicate substantiality, responsibility and dependability which the shipper wants, it will become a crystalizing point from which an analysis of possibility and application can be made, it will make every citizen in every industrial center of America the consignee of every producing farmer within 50 mi. of that industrial center, it will put every rural merchant within 50 mi. but six hours away from his base of supply.

The highway will never serve its ultimate purpose until every citizen, consumer or producer, has dependable and beneficial transportation access to it, and this is not possible except through a highway transport terminal.

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*Report of Committee on "Highway Transport Clearing Houses", National Highway Traffic Association; Tom Synder, Secretary, Indiana Highway Transport and Terminal Association, Chairman.

Character of Motor Transport Terminals

Large industrial centers with well populated surrounding territory will require an outbound and an inbound building or section.

These terminals could be established and sustained as private enterprises and be made profitable through a terminal or cartage fee to be added to the transportation charge, and through the operation of a cartage which would be in great demand on pick-ups and deliveries to consignees and from shippers who do not operate their own cartage vehicles, and from thousands of individual citizens who through highway transport and motor terminal service will become the consignees of agricultural producers. These terminals should be established and sustained through the cooperation of wholesale shippers associations, farm federations, and motor transport organizations.

The buildings should be long and narrow, providing the greatest possible amount of platform space on each side of building, insuring relief from building, platform or vehicle congestion. The building should be divided into route sections, local cartage vehicles delivering to platform on one side of building within route sections according to consignments, these consignments handled through narrow building to outbound platform for shipment that day or left within building if scheduled for following day shipment. The inbound building or section should be of the same character, permitting inbound transport truck to unload cargoes on one side of building and local cartage vehicles to clear from opposite side.

Because of the flexibility of motor transport, terminals will be very well cleared daily.

For outbound terminal, shipments consigned to routes over which less than daily service is rendered should not be received earlier than one day prior to scheduled departure of truck.

For inbound terminal, local cartage service could easily keep terminal clear.

Schedule should be established over all routes offering tonnage in exchange for service, the terminal clearing house keeping all shippers informed as to schedules, transport rates and service offered.

Many private truck owners can be found within or around industrial centers with whom contracts can be made to operate over routes on schedules, if the terminal clearing house will centralize the industrial demand for service. It is very evident, however, that a standardized fleet of trucks fully under the direction and control of a terminal clearing house system will render the most dependable and the most economical service.

All dry storage warehousing firms who see the great changes in transportation and distribution which highway transport is rapidly bringing about are providing liberally for motor truck platforms.

Large manufacturers of common commodities are already consigning to warehouse for distribution from that point, to store door anywhere within motor transport service from the warehouse, and by various sales systems eliminating the jobber, the broker, and the wholesaler.

Increased motor truck platform space is already in great demand at cold storage warehouses, because farm bureaus and federations are instructing agriculturalists to transport by motor truck to cold storage, avoiding the commission broker and holding their seasons crops for the unseasonable market periods, farm bureaus and farm federation committees acting as sales agents.

In smaller towns and cities in which highway tonnage is not great enough to sustain a motor transport terminal, storage warehouse are rapidly taking on this function and because many of them operate a cartage business in connection with warehousing, find that it fits in splendidly and contributes to their regular line of activity.

Thus the terminal problem for motor transport throughout America is not as great as it has been considered, the greater problem being that of limited platform space at warehouses and at shipper's places of business.

The trailer is rapidly being found a means of relief from the problem of limited platform space, and is perhaps best illustrated in several routes operated out of Indianapolis. Where shipping points along these routes receive as much as one or two ton, the consignments are loaded on a trailer and delivered to a local warehouse or cartage man who delivers to store door from trailer while the transport truck goes on its way and on its return the truck picks the trailer up, often well loaded for the return trip.

Trailers are also used as highway clearing houses in the transportation of milk, two trailers to one truck being used on some routes.

These trailers are dropped off at important highway crossings loaded with empty cans. The transport truck going on to the end of the route and returning loaded, picks up the trailers which have been loaded with full cans by smaller pick-up trucks, on a scheduled system which avoids delay for the transport truck.

Platforms are also being built at important highway cross-roads from which the transport truck picks up consignments or to which it unloads a great variety of commodities shipped to farmers in the neighborhood of the platform. These platforms are small clearing houses and have done much toward increasing highway transportation in Indiana.

Interurban electric railways have entered into competition with the motor truck in the transportation of live stock to the Indianapolis Stock Yards, but before it was possible for them to secure any portion of this business it was necessary for them to build stock yards and loading platforms at many points along their routes.

The electric roads have been trying for several years to secure this business, and a transport rate of 75% less than motor transport rates was offered, but it finally took the terminal clearing house and definitely scheduled service to get a portion of the business.

Terminal Costs

The cost of operating railway terminals upon the basis of hundredweight and the relation of this cost to the transportation receipts for hauls of various distances were apparently never analyzed until within the past few years. It must have been depressing to many of the larger carriers when it was learned that the terminal cost per hundredweight on the greater portion of their short-haul tonnage was greater than the total transportation rate allowed. The many almost insurmountable causes for this fact are due principally to yard, trackage and switching limitations which would not apply at all to motor transport terminals.

Surveys in many of America's industrial centers have disclosed that terminal building, yardage, and trackage expansion sufficient to meet the normal transportation demands upon steel rail carriers is physically and financially impossible.

Because of the flexibility of the motor truck, with its trailers, semi-trailers, and demountable bodies, and because every highway, street or alley becomes an outlet for the movement of tonnage, the highway transport terminal will never be subject to the limitations of steel rail terminals.

Because of the flexibility of motor transport equipment and its endless avenues of operation, short quick hauls, and L. T. L., or less than truck load shipments, will constitute its regular and natural service and as it will become the regular order to clear freight rapidly through a highway transport terminal, the terminal cost will be reduced to a figure far below steel rail terminal costs.

In the progress of American industry, production has far exceeded transportation. Transportation must be analyzed and its relation to production reestablished, the first step of which will be to find the economic relationship of highway transportation to steel rail and water ways, and to so correlate them that American industry will not be retarded by its twin brother, transportation.

Highway transport terminals are economically essential to the successful application of highway transportation.

The Grand Jury of Mobile County, Alabama, has reported that the bridges of the county are in poor condition and has called upon the county board to remedy conditions .

Store Door Delivery in Baltimore

At recent conference of the Transportation Committee of the Federal Highway Council, held in Baltimore, Md., with carriers and shippers, it was agreed to restore store-door delivery in that city. Store-door delivery existed in Baltimore and Washington for 47 years, being abolished in 1913 by the Interstate Commerce Commission on the grounds that it was discriminatory because of its use only in the two cities.

It is estimated that a saving of $2,000,000 annually to the shippers of Baltimore will be brought about. In addition, it will do much to overcome terminal congestion.

S. M. Williams, Chairman of the Federal Highway Council, says: "When the store-door delivery plan is again a reality in Baltimore, similar steps will be taken with respect to other cities, eight of which are already requesting the cooperation of the council in its establishment."

Concrete and Macadam Maintenance Costs

Comparative maintenance costs for a period of five years for waterbound macadam and concrete pavements on the Toronto-Hamilton Highway, Canada, are given by S. A. Cummiford, Chief Engineer of the Toronto-Hamilton Highway Commission. The surfaces have been exposed to the same kind and quantity of traffic.

Year	Concrete per Mile	Macadam per Mile
1916	$40.14	$1,116.17
1917	59.17	1,867.23
1918	60.99	5,721.75
1919	47.96	6,243.25
1920	78.38	3,398.01

Kings County, California, Buys State Highway Bonds

Kings County, California, has entered into an agreement with the State Highway Commission to purchase $1,000,000 of state road bonds at par and to resell them to private individuals, at a shrinkage not to exceed $30,000. This will enable the state to proceed with the construction of a bridge across the Kings River and the completion of the Sierras-to-the-Sea Highway.

Washington County, Pennsylvania, recently sold $500,000 of road bonds to Gordon & Co., of Pittsburgh, Pa. The proceeds will be used in improving the road from Hickory to Burgettstown.

Province of Ontario will Build Cement Plant

The Legislature of the Province of Ontario, Canada, has appropriated $1,000,000 for the construction of a cement plant. The province has had considerable difficulty in securing cement for public works and the new plant authorized will have a capacity of 300,000 bbl. per year. The cement will be used exclusively for public works.

Current Highway Legislation-VIII.

Illinois Law Permits State to Produce Road Materials and Counties to Build Roads—Michigan Raises Bonded Indebtedness Limit of Counties

(Continued from May 11)

During the past few months many important measures have been passed by the legislatures of various states, as noted in preceding articles of this series. Many of the states will have greater highway funds than ever before because of the actions of the legislatures making direct appropriations, authorizing bond issues, raising motor vehicle fees and placing a tax on gasoline. The outlook, therefore, for road development during the next few years is better than ever before. This article is the concluding one of the series and further action of the few pending bills will be reported in separate news items.

California

Road bills carrying appropriations of $2,000,000 were passed by the Senate on May 1.

Governor Stephens has signed a bill which limits the load of vehicles to 700 lb. per inch of the channel base width of the tire. For metal tires the limit is 500 lb. per inch of channel base width.

Connecticut

A bill has been introduced in the Senate which would restrict the obligations of street railway companies in the matter of paving to the area within 8 in. on either side of each rail, or a total width of 32 in. for single tracks, and a total of 64 in. for double tracks. This materially reduces street railways paving obligations.

A bill has been passed which places motor buses under the jurisdiction of the Public Utilities Commission.

The Legislative Committee on Finance has recommended a tax on gasoline, to yield about $1,000,000 annually, and an automobile property tax, to yield about $350,000 annually.

A bill has been introduced which proposes to increase fees for passenger automobiles about 50% and fees for trucks, pneumatically equipped and up to four tons capacity, 100%. Motor trucks with solid tires and over four tons capacity will pay about 150% greater fees.

The bill which proposes to free all toll bridges in the state has been favorably reported by the Legislative Committee on Finance.

Illinois

Governor Small has signed the Holaday Bill, which gives counties the right to bid on road construction and gives the state the right to buy or condemn cement plants for use by the state. Under this law counties may take contracts for road construction and be paid by state funds. The other provision of the law, permitting the state to acquire cement and other road material plants, is an entirely new departure in highway legislation.

The House Committee on Appropriations has reduced from $5,000,000 to $3,740,000 which is asked in a bill providing for refunding to counties money spent in building state roads.

The Meets Bill, removing all employees of the State Highway Department from the civil service, has been passed by the Senate.

Maine

The legislature has appropriated $105,850 for road work in 1921 and $106,000 for 1922. Towns receiving state aid must furnish all sand, gravel and rock for the improvements. One-sixth of all the mill tax highway fund is made available to carry out the provisions of this law.

Massachusetts

A bill increasing motor vehicle fees has been introduced in the Legislature. Motor trucks will pay from $20 to $80, according to capacity; trailers with rubber tires will pay the same as motor trucks; trailers with metal tires will pay double the truck fees; semi-trailers will pay half the fees of trailers on four wheels. Passenger cars, according to the bill, will pay fees from $15 to $40, according to horse power.

Michigan

A bill has been introduced which would create a board to market the state road bonds, permit the sale of $10,000,000 of road bonds annually instead of $5,000,000, and increase the interest rate on state road bonds to 5½%.

The county road law has been amended so as to prohibit counties which have adopted the county unit for road construction from returning to the township unit. An increase in the tax limit of $1 per $1,000 of valuation is also provided in another amendment to the county road law.

The motor vehicle law was amended by reducing the maximum gross weight of motor trucks from 15 to 14 tons.

A bill providing for a tax of 1 ct. per gallon on gasoline was killed in the House on April 20.

A bill proposing to tax motor bus and express companies 5% of gross receipts was killed in the House.

Pennsylvania

A law has been passed which classifies truck and semi-trailer as one vehicle, while trailers with four wheels are classified as trucks. Trailers with metal tires pay double the regular fees. Another section of this law provides for fines of $100 to $200 for overloading. The speed limit for trucks equipped with pneumatic tires is higher than that of trucks equipped with solid rubber tires.

Mexico Will Build Roads

The Mexican Government is planning to improve highways between principal cities so as to make them suitable to motor vehicular traffic. The Department of Communications and Public Works has announced that Mexico City is to be made the center of an extensive system of roads that will radiate to cities 50 to 300 mi. distant. The old highway between Mexico City and Toluca is again open to traffic and motor lines make daily trips between the two cities. Reconstruction of the highway between Mexico City and Vera Cruz is now in progress. A short time ago the road between the capital and Pachuca was finished.

Mackall Assails Townsend Bill

John N. Mackall, Chairman of the Maryland State Roads Commission, has written a letter to Senator Townsend, author of the Townsend Bill recently introduced in Congress, protesting against the provisions of the bill which create a federal highway commission and which require roads built under the act to be 66 ft. wide, with a wearing surface of 20 ft. Mr. Mackall has invited the Senate Committee on Roads, of which Senator Townsend is chairman, to make an inspection trip of Maryland's roads, so that the committee may be convinced that state highway departments, rather than a federal highway commission, are the best judges of what roads should be built and of how they should be built.

The Cocke County, Tennessee, Court has authorized a bond issue of $300,000 for constructing a section of the interstate highway leading from Jefferson County into North Carolina. The court also appropriated $120,000 for the construction of local roads in the county.

Rensselaer County, New York, has authorized a bond issue of $75,000 to pay the county's share of rebuilding the Troy-Cohoes Bridge, which was destroyed last year by the burning of the wooden pavement on the bridge.

Stuben County, New York, has fixed the maximum permitted cost per mile for road construction at $8,750. Previously the maximum permitted cost per mile was $12,500.

The Pennsylvania State Highway Department has caused the arrest of six men engaged on state road work in Montgomery County, for alleged padding of payrolls.

Road Work in Alaska

More than $700,000 will be spent on road work in Alaska this year, according to Capt. C. S. Ward of the Alaska Road Commission. The main road between Valdez and Fairbanks, which has been closed for two years, will be opened this summer. The commission will also open roads into the Kantishna mining district, which will also make the Mt. McKinley National Park more accessible as the road will cut through a corner of the park.

Other work planned by the commission is the completion of the road between Takotna and Ophir, in the Kuskokwim River district, a distance of 30 mi., which was started two years ago and the completion of the Chatanika-Circle road, which gives a through road from Valdez to Circle through the Fairbanks district.

Oregon Will Eliminate Three Grade Crossings

The Oregon State Highway Commission has been authorized by the Public Service Commission to eliminate three grade crossings in Baker County at an estimated cost of $74,500. One of the crossings located near Unity will be eliminated at a cost of $15,000; another crossing near Durkee at a cost of $18,000, and the third crossing near Huntington at a cost of $41,500. Forty per cent of the cost shall be borne by the highway commission, 40% by the railroad corporation, and 20% by Baker County.

Many Road Contracts Are Being Let

Road and street construction appears to be leading all other building industries. During the week ending April 23 there were 187 contracts for roads and streets awarded involving an expenditure of $17,857,304, according to figures compiled by the Asphalt Association. During the previous week 132 contracts were let, amounting to $14,512,728. During these two weeks bridge contracts totaling $2,381,487 were let. Other public works contracts awarded in the above period amount to about $13,000,000. Thus it is seen that more money is being spent on highways than on all other public improvements combined.

$40,000,000 Road Bond Issue Proposed for Connecticut

The members of the Connecticut Chamber of Commerce, by a referendum vote, have approved the plan for the issuance of $40,000,000 of state highway bonds. Most of the members favor issuing $10,000,000 of bonds per year for four years. The plan has been submitted to Governor Lake, State Highway Commissioner Bennett and Senator John H. Trumbull, Chairman of the Committee on Finance.

Marion County, Tennessee, has sold at par $250,000 of road bonds to Caldwell & Sons, Nashville, Tenn.

MEETINGS

Calendar of Coming Meetings

May 23-26.—American Society of Mechanical Engineers.—Spring meeting, Congress Hotel, Chicago, Ill. Secretary, Calvin W. Rice, 29 W. 39th St., New York City.

June 20-24—American Society for Testing Materials—Twenty-fourth annual meeting, Asbury Park, N. J. Secretary, C. L. Warwick, Engineer's Club Bldg., Philadelphia, Pa.

American Association of Engineers

The annual convention of the American Association of Engineers was held on May 9, 10 and 11 at Buffalo, N. Y., with about 150 delegates in attendance. Most of the time was given over to the consideration of organization, activities and related matters, rather than the consideration of techical subjects. Among the resolutions passed at the convention are those favoring, the continuance of federal aid appropriations, the taking of a highway traffic census, an increased allotment of federal aid to states having public lands and the passage of laws prohibiting the practise of engineering by corporations.

H. O. Garman, Chief Engineer, Indiana Public Utilities Commission, was elected president; A. N. Johnson, Dean of Engineering School, Maryland State College, first vice-president; A. S. Morris, Auditor, C. & N. W. R. R., second vice-president. H. W. Clausen was reelected treasurer.

International Association of Street Cleaning Officials

The annual conference of the International Association of Street Cleaning Officials will be held on Aug. 10, 11 and 12 at the Hotel La Salle, Chicago, Ill. The sessions will be opened by a luncheon at 12:30 in the East Room of the hotel on Aug. 10.

Kansas State Highway Commission Withdraws Federal Aid from Two Counties

The Kansas State Highway Commission has withdrawn federal aid allowances of $156,375 for Ford County and $164,190 for Douglas County. This action follows a recent announcement of the commission to take away federal aid allowances to counties which did not commence work on federal aid projects in a reasonable time. The allowances forfeited by Ford and Douglas Counties have been distributed to other counties.

York County, South Carolina, will vote on June 2 on a proposed $75,000 road bond issue.

PERSONAL MENTION

B. C. Harvey has been appointed city engineer of Rockford, Ill.

E. G. Hunt was recently appointed city engineer of Aberdeen, Wash.

Frank P. Schade was recently appointed city engineer of Cudahy, Wis.

W. V. Taylor has been appointed city engineer of Sarnia, Ont., Canada.

Frank Maloney has been appointed state highway engineer of Arkansas.

Theodore Lancott has been appointed city engineer of Hull, Que., Canada.

J. O. Corwin, Jr., has been appointed engineer of Travis County, Texas.

William T. Crowley has been appointed city engineer of Lock Haven, Pa.

D. S. McCalman has resigned as state highway superintendent of Wyoming.

C. J. Rogers has been appointed county engineer of Jefferson County, Alabama.

Charles Smithley has been appointed county engineer of Geary County, Kansas.

E. G. Elliott has been appointed county road engineer of Randolph County, West Virginia.

H. G. Schulde has been appointed district engineer of the Pennsylvania State Highway Department.

S. R. Batson has resigned as county engineer of Jefferson County, Alabama, to enter private practice.

Clarence B. Meyers has been appointed assistant engineer of the Bureau of Highways of Philadelphia, Pa.

C. E. Ellerbrook, formerly with the Michigan State Highway Department, is now with the Iowa State Highway Department.

H. E. Anschutz, formerly with the Georgia State Highway Department, is now engineer for the city planning commission of Atlanta, Ga.

L. L. Bateman, formerly resident engineer of the Michigan State Highway Department, has been appointed county engineer of Huron County, Michigan.

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APRIL 12, 1921

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JAMESTOWN, N. Y., MAY 25, 1921

Number 21

Road Construction Plants[*]

By B. H. PIEPMEIER[†]

Successful road work offers more possibilities for different types of plants than perhaps any other single line of building construction, and every section of road to be built is a field for intensive study and investigation by the engineer and contractor. A thorough examination of the road plants in operation for the past few years shows clearly the need of more careful study of plant problems than is ordinarly given by engineer or contractor.

A successful road contractor in Illinois states: "No equipment should be purchased by a contractor unless he has sufficient work in view to enable him to practically pay for the equipment with a reasonable profit." If this rule were followed by more contractors, on many jobs, there would undoubtedly be less equipment and more profit. Such a statement should in no way discourage the road contractor in equipping himself thoroughly to do economical road work, but should force him to make a more complete analysis of his job before he invests in a road-building plant.

In general, the building of a system of roads requires the installation of a number of small plants in preference to a few large plants. This has been particularly true in the past on account of (1) the contractor's inability to secure experienced and capable superintendents for handling large-plant operations; (2) railroad transportation falling short in the delivery of sufficient materials to keep large plants working efficiently; and (3) frequent breaking of the machinery required in large road construction plants—the break-down of one machine very often delaying the entire plant operations and causing undue expense.

The small construction unit necessitates doing many operations by hand at somewhat greater expense than if done with machinery; however, when the final analysis is made, the small unit will show considerable efficiency on account of the possibility of its operating many times independent of any one particular machine out of service through breakdown.

Conditions existing during the past few years have made it impossible for the contractor with a large plant layout to show a fair profit. As soon as labor and transportation conditions become more stabilized, the large plant will show a much greater efficiency.

Contractors must give considerable more thought to the design of road plant so that its successful operation may not be wholly dependent upon one piece of machinery. Many successful road contractors realize already that to insure a constant and uniform output, it is economy in many instances to duplicate machines.

Some contractors have installed a duplicate pumping system for the water supply, which is vital to the successful and economical operation of the road plant, and the additional cost of the duplicate unit is small compared to the advantage of being able to operate the plant without a delay.

In many instances duplicating concrete mixers has prevented a complete shutdown of operations. The average road job may not always justify a duplication of the mechanical units, but where a large season's work is required, a serious investigation of the advantage of the duplicate units should be made.

The transportation problem in road building is one of the most important factors in the economical construction of roads. Consequently this part of the plant operation should be given a great deal of study. The transportation cost should not only be estimated on the basis of the ton-mile cost but the effect it may have on the cost of operation of the remainder of the construction plan should be taken into consideration. Hauling cost varies from 20 to 40 cents per ton-mile. In a season's work a saving, therefore, of but a few cents per ton-mile may amount to several thousand dollars. The actual hauling costs may be exceedingly low, yet if the delivery affects the maximum output of the remainder of the plant, the inefficiency of the plant should naturally be charged against the transportation cost.

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[*] Paper presented at spring meeting of American Society of Mechanical Engineers.

[†] Engineer of Construction, Illinois State Highway Department.

Inasmuch as most specifications now prohibit storing road materials upon the subgrade, the road contractor is compelled to provide for transportation in one or two ways. He must deliver materials from his material yard to the road by industrial-railroad equipment or by truck. The industrial equipment, while expensive in first cost, will enable the contractor to complete his work with a minimum amount of trouble under normal conditions and regardless of weather, the average industrial equipment will insure a more uniform delivery of materials than any other unit that may be used. The chief objection to the industrial unit is that it is limited to road construction with grades ordinarily less than 4 per cent and a minimum number of railroad crossings. Further objection would be that the high initial cost demands a large mileage of roads be built each year in order to absorb the interest on the investment and the depreciation.

The other method of delivery is by truck or team. In recent years truck delivery has superseded team delivery, being more rapid and delivering material to a paving mixer from a mixer direct to the road with less disturbance to the roadbed. Truck transportation of road materials is very flexible and therefore suited to more different sections of work than perhaps any other method of transportation. It is especially suited to the delivery of mixed concrete from a central plant to the road being improved, and to the delivery of proportioned batches direct to the paving mixer or to a point at which the batch boxes may be transferred to a short industrial line which in turn delivers them to the paving mixer.

Delivery of Concrete from Central Mixing Plant

During the past few years the delivery of mixed concrete from a central mixing plant direct to the job has been attracting considerable attention. This method is worthy of study as it enables the contractor to centralize operations and in many instances to economize in plant operating expenses. The central mixing plant should be reasonably uniform in design and simple in operation. A study of the central mixing plants in use during the past two years shows no two very similar in designs. It would seem possible that unloading aggregate and cement from railroad cars, mixing the materials to the desired proportions and consistency and turning out a mixed concrete, could be standardized to such an extent that central plants could be simplified and made more economical in operation. It is hoped that the mechanical engineer and the equipment designer will assist in the design of a practical and economical central-mixing-plant unit.

Although central mixing plants may be fairly uniform in design, the delivery of the concrete from the plant to the road will vary considerably to suit the existing local conditions. Mixed concrete may be delivered by industrial equipment, provided the hauls are reasonably short and the equipment is designed for small loads with considerable speed in transportation. The small pneumatic-tired truck will usually prove the most efficient machine for delivery of mixed concrete, taking the individual batch of mixed concrete direct from the mixer to the road being improved in the least possible time.

Use of the Pneumatic-Tired Truck

The pneumatic-tired truck is essential when speed is an important factor in delivery and where it is necessary to do considerable hauling over the subgrade. This truck will usually reduce the load on the subgrade to less than 125 lb. per sq. in. of surface, and it has been found that this pressure, even though frequently applied, does not seriously injure or displace a prepared subgrade having average soil conditions.

It is true that it is practically impossible to deliver materials over earth roads with trucks when the roads are muddy or during rainy periods. However, the road may be materially improved and the truck used practically the entire construction season if the road is constantly maintained by the use of the road drag and given an application of half a gallon of oil per square yard of surface early in the construction season.

The light pneumatic-tired truck may also be used for the delivery of proportioned batches of aggregates direct to the paving mixer on the road being improved. There are now on the market many types of batch boxes and dump bodies which permit the batches to be dumped directly into the skip of the paving mixer. This method has proved to be very satisfactory. It differs from the delivery of mixed concrete in that a paving mixer is used instead of a stationery building mixer, and most of the operations of the contractor are out on the job where the road is actually being laid.

Improvements in Design of Equipment Desirable

The plant investment of the road contractor of today is entirely too expensive compared with the work accomplished during a single construction season or from one particular installation of a construction plant. From $60,000 to $100,000 worth of plant equipment is frequently set up to build less than ten miles of highway. This is equivalent to charging off $2500 to $3000 for equipment against every mile of road built. It is doubtful whether there is any other building construction in which so much depreciation and interest on plant investment must

(Concluded on Page 276)

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ROAD CONSTRUCTION MACHINERY PROBLEMS

After the invention of the steam engine, the industrial system of England and the United States underwent a change which economists term the "industrial revolution." With machines performing many of the operations formerly done by human hands, the whole industrial order was changed. Men who formerly did their work alone in their shops, gathered for work in a large factory; division of labor was carried out so that a man performed only a single operation; but most important, the production of commodities was greatly speeded up, thus permitting the turning out of great quantities of goods at low cost.

In the short space of the last five years, one may see a revolution in the methods of road building—a revolution similar to the industrial revolution of the last century. The handling of materials is now accomplished by the steam shovel, the power loader, the motor truck and the industrial railway. In Maricopa County, Arizona, work is being done on a $4,000,000 road contract in which the cement, from the time it leaves the mill to the time it enters the road as concrete, does not touch human hands.

But the introduction of labor saving machinery has not yet proved the panacea of road contractors' troubles. The truth is that some contractors using latest road machinery have failed to make money. Modern road machinery is expensive and if a road plant is improperly laid out, profits rapidly vanish. For example, a contractor in Delaware last year went into the hands of a receiver because he failed to provide transportation facilities which would keep his two mixers supplied.

In the road industry, as in other industries, the use of labor saving machinery must result in volume production. The selection of equipment, the layout of the road plant and the co-ordination of all phases of the work must be made so as to secure maximum efficiency. Yet it is not hard to find outfits capable of turning out 1,000 ft. of road a day, turning out only half this footage. As A. R. Hirst, State Highway Engineer of Wisconsin, recently said, "Contractors have put $100,000 of equipment on a job; then if a 50 ct. oil gage broke on the mixer pump, the whole thing stood still."

Elsewhere in this issue are printed two articles dealing with the problems of modern road construction machinery. These articles, in view of the growing use of road machinery, are of particular interest and may well be read with profit.

THE NEW ILLINOIS ROAD LAW

Governor Small of Illinois has signed the Holaday Bill, which contains two important provisions that may have great influence upon road building in that state. Under this new law counties of the state are empowered to enter into competitive bidding for road work, in other words, to engage in the road contracting business. The other provision of the law permits the state to acquire, by purchase or condemnation, cement and other road material plants, thus allowing the state to engage in the production of road materials.

This is an extremely radical departure, for it permits the state and its counties to engage in private enterprise, or at least what ordinarily has been private enterprise. This law apparently results from the feeling held by officials in that state that road contractors and materials producers have not sufficiently lowered prices.

It may be that this law will be used merely as a cudgel in the attempt to lower construction costs, for most experiments of governmental undertaking of private enterprise have been unsuccessful. But if the counties of Illinois do enter upon the actual construction of highways, this attempt to secure lower road costs will certainly be watched with interest by both engineers and contractors.

Road Construction Plants

(Concluded from Page 274)

be charged off on so small an amount of work. The mechanical engineer, equipment designer and contractor should apparently spend more time in the design of road-construction plants in order to insure a greater output with less initial investment.

Many of our road-building machines are being made larger, more cumbersome, and more expensive each year. The fact that road-building machinery is subjected to more severe use than perhaps any other machinery used in building construction has induced the manufacturer to add to his equipment each year to insure more rigid construction. Many machines, such as the concrete paving mixer, can undoubtedly be completely redesigned and a machine produced much smaller in size, to mix more concrete and be less cumbersome on the job.

Mixer manufacturers have continued to improve the design of their paving mixers by following the same principles of mixing that have been in use for many years. It seems absurd that we must have a concrete paver costing from $8,000 to $12,000 and weighing from 10 to 15 tons that will lay less than two miles of 18-ft. concrete road in thirty days. It seems absurd also that we should still be using mixers that require 60 seconds of time for the mixing of aggregate and cement when it should be possible to do the same amount of mixing by some mechanical means in less than 15 seconds. If such a machine could be produced, a one-bag paver would turn out as much concrete as our present four-big pavers. The present paver is also designed so that the mixing is concealed from the view of the mixer operator. This prevents absolutely the uniform consistency essential in securing a good concrete.

If the mixer designer can produce a smaller machine having a greater output per hour of operation and so designed that the consistency of the concrete produced can be controlled by the operator instead of by some unsatisfactory mechanical means, the results will be a wonderful aid to the road-building industry.

Also Room for Improvement in Railroad Equipment

It also seems possible that a very material improvement can be made in the present railroad transportation equipment. Practically all road contractors now unload aggregates from open-top cars by means of clam shells. This method is not always the most economical, but the contractor is forced to use it as he cannot secure all hopper-bottom cars he might desire. On account of the large volume of road materials to be delivered by railroad cars, some type of car should be designed that would permit of more rapid unloading by more economical methods. If this is not done, it is hoped at least that open-top-car manufacturers will improve the design of their cars and make them so that they can be more easily unloaded with clam-shell equipment. Not only would such improvement aid the individual unloading the car, but the railroad company would add to the life of its equipment.

Many open-top cars are now designed with projecting angles, rivets, bolts, braces, timbers, etc., which interfere with the efficient operation of the clam shell. It is difficult to understand why railroad cars could not be designed so that the interior of the car would be perfectly smooth. In fact, it would be practicable and economical for all open-top cars to be built with a filet having a radius of about 18 in. in the bottom angle at the ends of the car. The curved bottom angles would permit the cars to be emptied more rapidly and economically either with hand shovels or clam shells.

Further investigation should also be made of the use of open-top removable batch boxes for railroad transportation of materials. While the substitution of standardized batch boxes for open-top care would be a very radical departure from present equipment, the average construction plant could be designed to handle the boxes much more economically than the loose materials.

Senate Roads Committee Holds Hearings

The Senate Committee on Roads, of which Senator Townsend is chairman, is holding hearings on the bill recently introduced by Senator Townsend. Many persons have been called to testify before the committee. So far, witnesses who have been representatives of the automotive industry have generally favored the Townsend Bill, whereas state highway officials in general have spoken in favor of the Dowell Bill, recently introduced in the House.

Gray Silver, Washington representative of the American Farm Bureau, appeared as a witness and spoke against the Townsend Bill. Mr. Silver said this bill creates an unnecessary and expensive special commission; gives exclusive power to the federal commission to select roads and designate pavements to be laid, although the states contribute half of the money; requires an unnecessary width of pavement in some sections; and by building costly pavements under the proposed law, state road funds would be absorbed and other road construction retarded.

Florida Special Road District Bond Issue Declared Illegal

The Florida Supreme Court, in the case of the special road and bridge district No. 2 of De Soto County, has declared that the notice of election under which the district was formed to be insufficient to authorize the issue of bonds. Under the law, notices of special road district elections must contain the estimated cost of roads and bridges to be built.

Mechanical Needs In Road Machinery *

By R. C. MARSHALL, Jr.†

The interest of the mechanical engineer in highway construction centers in the equipment used. This equipment has made great strides in recent years and will undoubtedly continue to do so, yet the equipment needs for road building might be called comparatively simple. Consider a concrete road. All the average road builder needs is a light, portable plant capable of handling, mixing and finishing 400 cu. yd. of concrete every day, with no delay for repairs.

The charge has been made that modern road-building methods have so increased overhead expense that they have accomplished little saving. This may be an exaggeration, but the elaborate equipment now used has undoubtedly increased the overhead to such a degree that steady output of the plant is essential to financial success.

In order that this overhead expense may be kept within reason and highway costs estimated with profitable accuracy, it is essential that contractors have equipment capable of maintaining a steady flow of materials; first, from unloading point to mixer and, second, from there to the finished road. This is the problem confronting the field force and one which must find solution if road building is to become financially safe. Until further development of equipment can assure more continuous performance, construction companies must insure themselves against the loss caused by frequent delays.

The slogan of the designer should be, "Make the machine foolproof." Increased strength may demand heavier parts and increased first cost but this is inconsiderable compared with the loss due to one breakdown.

Last year's work, on account of spasmodic and continued delay, was not conducive to a careful study of equipment needs. Transportation troubles to disrupted operations that contractors were obliged to grasp at any expedient to push their work. This, combined with labor and material scarcity, left them little time for a constructive study of their specific equipment needs. Of one thing, however, nearly every road builder is keenly aware. His work suffered heavily from frequent interruptions which disorganized his force and increased the unit overhead cost. Delays from transportation difficulties and equipment trouble caused the overhead expense to absorb a large portion of his profit and in some cases much of his capital. Delays caused by equipment trouble are traceable to three main causes: First, lack of skilful mechanics; second, lack of standardization in design and, third, lack of accurate information concerning the adaptability, capacity and operation of machines.

The lack of skilful mechanics concerns both manufacturers and contractors. An equipment company may expend much time and money in perfecting designs or improving the quality of the workmanship, but if its machines are placed in the hands of incompetent operators, the money spent for them is wasted. Incompetent operators can readily offset the advantages of efficient equipment and well-planned work. Under careless handling the heavy delays for repairs mean a loss of money to the road builder and to the manufacturer a loss of that valuable asset, good will.

An economical solution of the shortage of good operators might be effected by establishing for them a short course of instruction during winter months when construction is slack. Savings effected in the field by competent operators would amount to many times the cost of their instruction. One of the worst obstacles to continuous output would thus be removed.

The second significant source of delay is a lack of standardization in equipment where standardization is possible. Road-building plants are generally made up of machines from half a dozen different manufacturers, and to be prepared even for the usual run of minor field repairs on all machines requires a more or less elaborate machine shop. The financial burden of carrying duplicate units or a sufficient number of spare parts is too great for an already heavy overhead, and in order that this expense may be held within reason, greater interchangeability of parts should be possible.

The amount of saving that might be effected through standardization of road equipment is not generally appreciated. To build a medium-sized high-type section requires a daily field payroll of three or four hundred dollars and an overhead of probably another hundred. So that five hundred dollars per day is not an unusual cost. An employee cannot be laid off every time a breakdown occurs, and since the overhead goes steadily on, fifty dollars an hour may be considered an estimate of the cost of equipment delays.

The third pressing need of road builders, and the one which probably results more frequently in disaster, is a lack of unbiased and authoritative information concerning the adaptability, capacity and operation of machines. Lack of such information has already brought disaster to numerous individual

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*Paper presented at spring meeting of American Society of Mechanical Engineers.

†General Manager, Associated General Contractors of America.

companies, both old and young; and as new concerns are constantly taking up road work, it is essential that they secure authoritative mechanical advice.

What contractors need is accurate data showing under what conditions a certain type of machine is suitable, how long it may reasonably be expected to last, and what output it can deliver under normal working conditions. If this information can be made available, construction companies may be relied upon to intelligently select machines. They will then be able to co-ordinate their plant and estimate their costs.

Ask Lower Freight Rates On Road Materials In Texas

A hearing will be held in Austin, Tex., on June 6 before Thomas P. Healy, Examiner for the Interstate Commerce Commission, relative to decreased freight rates on road materials. Road builders in the state are making vigorous efforts to have last year's order of the commission modified.

Commenting on the high freight rates on road materials, County Judge Allen of Dallas County, Texas, says that it is necessary for freight rates to come down if county road bond issues are to build the contemplated mileages. Dallas County, with a $6,000,000 bond issue plans to build 300 mi. of road, but will be unable to complete this mileage under existing freight rates.

Road Builders In Cape May County, New Jersey, Indicted

Twenty-four men, contractors and members of the Cape May County, New Jersey, Board of Freeholders, have been indicted by the special grand jury investigating alleged road frauds. The transactions out of which the indictments grew are road contracts over the past five years. Of the 24 indicted, 15 are chosen freeholders, past or present, 7 contractors and 2 county officials. One contractor has pleaded guilty to conspiracy.

Illinois Railroad Fights Bus Lines

Protest against the use of Illinois roads by motor bus companies as an "appropriation of public improvement to private interests" and "without any compensation" was filed with the Illinois Public Utilities Commission on May 11 by the Chicago, Rock Island and Pacific Railroad Co. The railroad company objects to the operation of the Peoria White Star Bus Co. and the Ivy Way Bus Line, which the railroad complains will force it to curtail its service.

Ten Indiana Contractors Ordered To Secure New Bonds

Ten contractors having contracts for road work in Indiana aggregating $2,225,198, have been ordered by the State Highway Commission to obtain new bonds because their present bonds are with companies of unsatisfactory standing.

Pennsylvania Urges Use of Local Labor

The Pennsylvania State Highway Department has urged contractors engaged on road work to employ local labor rather than import the labor needed. The following statement to contractors has been issued by the department:

"A survey of the state discloses the fact that in almost every community there are large numbers of unemployed men and that this number is increasing weekly. The highway department is anxious to relieve this situation in so far as the contracts under its direction will afford employment. In view of the fact that practically all communities are affected alike and that there is available a local supply of labor for all our existing contracts, our contractors are being urged to seek the services of men living in the community in which they are operating rather than to import labor from a distance; and especially are they being urged not to interfere with such labor as is, or will be, employed on the farms of the commonwealth."

Oregon Farmers Buy Road Bonds

After Lane County, Oregon, had received bids on $30,000 of road bonds of 90 by local bankers and 94½ by Portland bankers, the farmers in the county have agreed to purchase the bonds at par. The farmers feel that they will be amply repaid by the improvement of the roads of the county.

Wyoming Passes State Bond Issue

The State of Wyoming on March 10 passed a state road bond issue of $1,800,000. The vote polled was overwhelmingly in favor of the proposed bond issue, only a few sections reporting unfavorably.

Spokane County, Washington, has recently sold $150,000 of 5% road bonds of the Cheney District. The bonds were sold below par but residents of the district subscribed a sufficient amount to make up the difference between selling price and par.

The State of Nebraska, plans to improve 400 mi. of highways during this year. The work extends over 40 counties and involves an expenditure of approximately $1,500,000 of federal and state funds.

Counties of Georgia, during the past five years have issued bonds aggregating $18,000,000, according to Frank Reynolds, Secretary of the Georgia State Automobile Association.

American Legion Posts in Illinois, plan to plant more than 10,000 trees on May 30 along the roads in that state in remembrance of soldiers who participated in the war.

Four bridges in Adams County, Pennsylvania, have been damaged by truck traffic this spring and have been closed for repairs.

New Hampshire Good Roads Association

OFFICERS FOR 1921

HARRY L. SMITH, President	Lakeport
JERRY KILLORY, Secretary and Treasurer	Laconia
C. M. BROOKS, First Vice-President	Keene
OZMAN W. FERNALD, Second Vice-President	Berlin
Board of Directors	
OVID F. WINSLOW	Nashua
F. H. COLBURN	Concord

Contracts have been awarded for federal aid projects to Winslow & Cummings, Nashua, for 1 mi. of penetration macadam in Bethlehem, and to the Marshfield Construction Co., Marshfield, Mass., for 2.5 mi. of gravel in the town of Tuftonborough.

Bids will be opened May 25, 1921, for 1.25 mi. of modified asphalt pavement in the Town of Merrimack.

In spite of the fact that a number of the hard surfaced roads came through the winter in a very poor condition, the gravel and dirt roads in the northern part of the state are in better condition at the present time than they were at any time last year.

Joseph Normandeau has just completed a stretch of cement concrete road for the state and City of Concord on Bridge Street. This is the first piece of cement concrete in the City of Concord.

The steel is on the ground for the construction of the new bridge at Winchester and the Eugene A. Simpson Co., which has this contract will rush the work to completion. It is hoped that the bridge will be opened to the public by the first of August.

The first of the bulletins in regard to the condition of the roads throughout the state was issued by the Highway Department on May 12. These bulletins are issued monthly and are available to anyone upon request.

The contract for furnishing and applying road oil for the department for the season has been awarded to the Standard Oil Co.; for cold application of tar to the Barrett Co., and for cold patching material to the American Tar Co.

Prominent men in the affairs of the states of New Hampshire and Maine, as well as in the Navy Department, recently attended the launching of the first caisson for the Interstate Memorial Bridge to be erected across the Piscataqua River by the States of New Hampshire and Maine and the Federal Government. The bridge will cost $1,500,000, divided between the two states and the Government, and the launching of the first caisson is the first visible work on the bridge. The span will be dedicated to the world war heroes of the two states.

The caisson was launched at high tide from the old Concord railroad docks in the North End and towed into the stream and sunk on the New Hampshire side. The caisson is 90 ft. long, 36 ft. high and 30 ft. wide. At the minute it was sunk there was a din from whistles on shipping in the harbor as well as bell ringing in this city.

At the invitation of Ex-Governor John H. Bartlett, Secretary of the Bridge Commission, Governor Albert O. Brown of New Hampshire and Governor Percival P. Baxter of Maine and former Governor Carl Milliken of Maine, with Admiral Parks, Chief of the Department of Construction of the Bureau of Yards and Docks of the Navy Department as personal representatives of Assistant Secretary of the Navy Theodore Roosevelt, as well as a distinguished party of Portsmouth and Kittery officials, witnessed the ceremonies preceding the sinking of the caisson. Following the ceremonies the guests were entertained at luncheon by former Governor Bartlett.

The total of the appropriations granted for the City of Manchester budget for 1921, is $1,875,373, which is $350,000 less than the amounts asked for

Among the amounts requested and granted are the following: Highways, $518,000 asked and $391,000 granted; Engineers, $18,100 asked and $9,000 granted.

Attorney Oscar L. Loring of Laconia has rendered an opinion that the Nashua Mayor and Board of Alderman were in contempt in voting daylight saving when the State Legislature had passed a statute against it. The Grange is the only organized body which has been combating the plan, but it is not expected that it will do anything now that the city voted for the plan through its aldermen.

Manchester's bridge program, calling for an outlay of $880,000, is progressing and it is expected that the proposed Amoskeag Bridge will be completed before winter. Although the finance commission vetoed the South End bridge project the commissioners announced that they were in favor of a bridge, but before they would approve of the bridge, some cost figures were desired. With the commission expressing such an opinion, citizens of Manchester feel that the South End Bridge will be built within the next year at the latest.

At the present time the only action in the bridge program is the bond issue for the Amoskeag Bridge

The finance commission has approved a $160,000 bond issue and a resolution calling for an additional $30,000 is in the hands of the aldermanic finance committee, and it is expected it will be reported favorably so that the entire $190,000 can be used for a bond issue to build the bridge.

According to plans which the Highway Commission has outlined the Amoskeag Bridge work will be started within a few weeks after the bond issue is approved by the city and sold to bankers. The commission has a tentative cost price of $185,000, according to figures obtained from a firm of consulting engineers.

The firm of Fay, Spoffard & Thorndike of Boston, one of the foremost consulting engineering firms in the country, has looked into the Amoskeag Bridge project for the Highway Commission and the firm's experts state that a bridge for $185,000 can be built on the site of the old structure providing the work is started some time in May. The engineers point out the fact that the old piers are of sufficient strength to support a new bridge, which would eliminate the expense of building new piers.

Manchester's best bridge across the Merrimack River, the Granite Street structure was built during the administration of Mayor William C. Clarke. It is one of the best bridges spanning the Merrimack in either New Hampshire or Massachusetts. The McGregor Bridge is in fairly good condition. Another good bridge is the so-called Kelley's Falls bridge which spans the North Weare branch of the Boston & Maine R. R. and the Piscataqua River.

New York State Road Builders' Association

OFFICERS

JOHN H. GORDON, President	Albany
C. I. HENDRICKSON, Vice President	Syracuse
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FRED E. ELLIS	Melrose, Mass.
W. A. GREENFIELD	Hornell
C. J. HENDRICKSON	Syracuse
J. F. PADDELFORD	Sherburne

At the letting which took place on Tuesday, May 3, there were 18 contracts advertised—11 for construction work and 7 repair contracts. The entire amount involved in the letting was $2,354,941.27. There were 100 bidders, the largest number ever participating in a letting.

The following members of the New York State Road Builders' Association were low bidders:

Richard Hopkins, Troy, N. Y., Altamont-Voorheesville Road, Albany County Road, 6.85 mi., $226,258, engineer's estimate $241,739.

Richard Hopkins, Troy, N. Y., Varysburg-Warsaw Road, Pt. 1, Wyoming County, 3.55 mi., $148,925.80, engineer's estimate $160,313.70.

A. J. Rockwood, Rochester, N. Y., Genoa-North Lansing Road, Cayuga County, 5.04 mi., $174,194.65, engineer's estimate $179,705.80.

Harrison Engineering & Construction Co., Buffalo, N. Y., Westfield-Brocton Road, Chautauqua County, 6.24 mi., $230,998.25, engineer's estimate $255,552.25.

Lawton & Van Wirt, Glens Falls, N. Y., Manny Corners-Blue Corners Road, Montgomery County, 3.57 mi., $105,585.50, engineer's estimate $118,433.50.

Samuel Rosoff, Jr., New York, N. Y., Warsaw Village-West Buffalo Street, Wyoming County, 1.22 mi., $108,483.10, engineer's estimate $114.287.

DeGraff & Hogeboom, Inc., Kingston, N. Y., a repair contract in Sullivan County, $57,432, engineer's estimate $74,880.

Another very interesting letting took place on Wednesday, May 4, the Harrison Engineering Construction Corporation of Buffalo, N. Y., being the low bidder on Repair Contract No. 1288, Erie County. The amount of the bid was $68,287,10 and the engineer's estimate was $75,452.85.

The W. T. Thayer Company, Chateugay, N. Y., was the low bidder on a repair contract in St. Lawrence County. The amount of the bid was $31,712.20 and the engineer's estimate was $34,929.60.

There were 18 roads advertised, 9 of them being repair contracts. There were 91 bidders. No bids were received on the Highland-New Paltz job in Ulster County.

Morrison's Crossing, which has been the scene of many fatal accidents, will be eliminated, according to a decision reached by Commissioner Sisson after consultation with a committee of business men. To straighten the Genesee Turnpike from Morrison's Crossing to High Bridge, it was decided to build a new road from the crossing to the proposed boulevard in the City of Sherrill.

In the letting which will take place on Friday, June

3, there are 10 roads advertised for improvement. The construction contracts involve approximately 35.32 mi., while 8 repair contracts involve 16.31 mi. On Tuesday, June 7, 12 roads, involving 32.24 mi., are advertised for improvement, and 7 for repairs, the latter having a total length of 121.80 mi.

Ideal weather for road building; every road contractor happy and satisfied. Monthly estimates are coming in showing the good work going on.

Massachusetts Highway Association

OFFICERS FOR 1921

HENRY V. MACKSEY, President	Framingham
JOHN M. McCARTHY, Secretary	Natick
CHARLES A. BROWN, Treasurer	Wellesley

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Announcement

This section of the paper is open to members of the Massachusetts Highway Association for the discussion of matters directly connected with road interests. Members are requested to submit items of interest for use in this column.

Address all communications to GOOD ROADS, P. O. Box 2705, Boston.

The regular quarterly meeting of the Massachusetts Highway Association was held Thursday, May 11th. The members met at Charlesgate Road, Boston, in automobiles and proceeded to East Cambridge, Somerville, Everett and Revere Beach Parkway, then to Salem and Peabody. At Peabody the members were met by His Honor, Mayor Shea and City Engineer, Frank Emerson. They were then escorted about Peabody and shown the different types of road construction, including reinforced concrete and granite block, cement grout and tar macadam.

After this tour of inspection the members visited the plant of the Essex Trap Rock Co. at West Peabody where they were presented with carnations and cigars.

They were shown the rock from the time it is blasted at the ledge until it is loaded in the cars.

After leaving Peabody the members visited the Newburyport Turnpike where work is being done by the Haasam Company. The members had an opportunity of seing a complete concrete paving plant in operation.

The next stop was at "Wardhurst" the popular road house conducted by the famous actor Hap Ward who was on hand to extend a cordial invitation to all present.

President Macksey called the meeting to order, there being about 160 members and guests present.

After the luncheon moving pictures were presented showing different types of road machinery.

Following the pictures, the members visited the sand plant of the New England Sand & Gravel Co. at West Peabody. This plant is situated in a very wet spot, the sand being of the so-called washed gravel type.

The sand and water is dumped into a large bin about 100 ft. high. The water is then drained and the gravel screened into different sizes and loaded into cars by gravity. The gravel when loaded in cars is absolutely clean and free from dirt.

The feature of the trip was the excellent dinner served.

After the luncheon, Mayor Creamer of Lynn was introduced as the first speaker, and he spoke regarding the taxation of automobiles and the expenditures of the automobile fees. He informed the members that in his opinion the cities and towns should receive a certain percentage of the automobile fees, as certainly the expenses of maintaining their roads each year increased to such an amount that it becomes necessary to build roads by bond issues.

To these remarks, the next speaker, James A. Synan, Commissioner, Massachusetts, Public Works Department, explained to the members why the state should not return a certain percentage of the automobile fees to the cities and towns. Mr. Synan being very well posted on automobile fees and the necessity for state control of this money, certainly delivered a very good address in reply to Mayor Creamer of Lynn.

Mayor Creamer, not being satisfied with the information given by Mr. Synan, was given the privilege of explaining further why the state should not spend the entire amount of the automoibile fees under its supervision.

Once more Mr. Synan spoke on the automobile fee and its distribution, again insisting that this money should be taken care of as the state saw fit, as the small cities and towns would not accomplish much without state aid.

Mayor Sullivan of Salem was the next speaker. He informed the members that like Mayor Creamer, he was in favor of good roads.

Members and guests were present from New York, Providence, R. I., Worcester, Mass., and New Hampshire.

In their upward march toward new records motor vehicle registrations in Massachusetts have already passed the quarter-million mark and have established new high points, both in respect to passenger cars and commercial vehicles. For the first four months of the year the number of vehicles registered is more than 22% in excess of that for the same period of last year and the number plates of passenger cars are already above 200,000, a figure that was not reached until much later in the preceding year. At the present rate the registration figures will pass the total for the whole of 1920 before the middle of June.

The figures for the four months ending April 30 show regsitrations of 256,732 cars and trucks compared with 210,350 in the same part of last year. This is an increase of 46,382 or a little more than 22%. The passenger cars made the largest gain both numerically and in percentage. The number of cars registered this year is 211,261 against 169,957 a year ago. This is an increase of 41,304 in number, amounting to more than 24%. The trucks registered are 45,471 compared with 40,393 in the corresponding period of 1920, an increase of 5,078 which is a percentage gain of 12½.

During the whole of last year there were registered 304,631 motor cars and trucks, including 253,245 cars and 51,386 commercial vehicles. Thus the total registration at present is less than 48,000 behind the total of last year. As registration certificates are being taken out at the rate of 1,200 a day it will require about forty days to reach the grand total of last year.

Motorists already have paid in fees, for licenses and registration, more than $3,000,000 into the state treasury. During the whole of 1920, the fee fund amounted to $3,860,231, and if the rate of increase that has prevailed during the first part of this year is maintained, the contribution of the motorists to maintain roads will amount to over $4,500,000. Last year at this time the fees paid in amounted to a little less than $2,500,000.

The Lincoln Highway Association has announced the names of the experts retained to collaborate in the final detailed design of the "ideal section," which is soon to be built on the Lincoln Highway with funds provided by the United States Rubber Co.

The letting of the contract for the construction has been placed in the hands of Lockwood, Green & Co., engineers, of Boston, a firm that has been engaged in the building of large industrial and commercial projects of note throughout the country.

Collaborating with Lockwood, Green & Co. will be W. G. Thompson, a consulting highway engineer who was lately state highway engineer of New Jersey. Mr. Thompson is an acknowledged authority in highway building. He was for ten years a member of the corps of engineers which, under Gen. Goethals, built the Panama Canal.

That the beautification of the "ideal section" may be of the same high standard as the construction work on the road itself, Jens Jensen of Chicago, one of America's leading landscape architects, has been engaged. Mr. Jensen is a governing member of the Chicago Art Institute, a member of the board of directors of the Chicago Geographical Society, president of the Friends of Our Native Landscape and a fellow of the American Geographical Society.

Installation of a national system of color signals for the control of motor traffic on national and state highways, similar to the standardized use of red, yellow and green in railroad systems, is suggested by highway officials of New Jersey, who have approved of a bill for the adoption of the plan in that state.

The bill, which contains measures approved by the committee on Standards of the American Association of State Highway Officials, would have red signs to indicate first degree danger such as railroad crossings, dead ends of roads, or lift bridges; yellow indicating second degree danger at curves or grades, and green showing moving or traffic danger only, to be used at road intersections.

Many national organizations interested in the move to reduce the annual automobile toll have expressed their endorsement of the bill's proposals. Recent investigation, it is pointed out, shows that many leading American cities have failed to unite on a uniform use of color in highway signals. Red, for instance, meaning first degree danger or are absolute stop signal in one town, is used in the next town as a place where green should be employed.

Two hundred American cities and towns are reported already to have adopted this color signal project while many more, highway officials believe, will fall in line the coming year.

Highway engineers are agreed that caution must be observed in the next few years wherever roads are constructed in Massachusetts—that the new building program must contemplate the necessity for resisting ever-increasing loads.

Motor trucks with dead weights of 3,000 to 4,500 lb. on the rear wheels are the rule today. They cannot be excluded from the highways. They should not be. The roads are free to all, and while it is fair that there be a tax imposed commensurate with the road destruction caused by the extra-heavy weights, it is not fair to follow out the idea of the extremists and permit motor traffic only on certain portions of highways.

Research engineers declare that a weight of 7,500 lb. on the rear wheel of a motor truck, moving at a rate of 15 mi. an hour, will make a blow, i. e., "impact," equal to a weight of 43,000 lb. if the wheel drops 1 in.

The increase in impact is in direct arithmetical progression as the speed advances.

This impact is made apparent first in the base of the road itself, where the concrete or other filler material is forced apart and downward. Then follows a new depression in the face of the pavement itself, with a resultant heavier impact for the next truck.

It is apparent that building new highways and repairing old ones must be carried out with consideration of these facts in order to provide for the ever-increasing loads of the future, for unless the railroad rates come down, shipping by truck will be the logical means of transport in future. The roads, therefore, must be constructed to meet the situation and the new conditions.

Travel by road between Boston and Springfield is going to be rather difficult this summer because of the fact that the mass of traffic has become so great that much road rebuilding is necessary. With contracts that are let and which are soon to be let there will be no less than five separate construction jobs in progress between Worcester and Springfield, which will interfere with travel for the greater part of the season. In some cases the new road will be built one-half at a time so that vehicles can be worked through with a proper signalling system. But at other places detours will be necessary.

Three contracts have been started recently. They are in Spencer, East Brookfield and Palmer. For the most part the new road will have a 20-ft. surface of reinforced concrete with a hard shoulder, 3 ft. wide on either side. There is another contract for bituminous macadam in the same locality. These are all large jobs and will require most of the summer to complete. While the motorists will be inconvenienced for several months he has the consolation of knowing that when the work is done the Worcester-Springfield route will be perhaps the finest in the state.

The fifth road contract is at Leicester Hill. A new road is being built around the steep grade and does not interfere materially with traffic over the old road. The new work should be finished about July 1 and the removal of the hill will do much to compensate for the temporary interruption of travel along the balance of the route between Worcester and Springfield.

In the City of Boston, if it were apportioned equally, the head of every family would contribute $4.29 annually to pay pensions of retired municipal employees and an additional 50 ct. to pay the pensions of retired employees of Suffolk County and state employees, bringing the total up to approximately $5 a year.

The total cost of pensions in 1914 in Massachusetts was about $720,000. Today the total cost is about $1,500,000. In 1914 the City of Boston was paying $450,000 in pensions, while today it is paying $670,000. All other cities of the state were paying $115,000 in 1914, and are today paying $360,000 in pensions. Retired state employees were paid $120,516 in 1914, and are this year receiving $385,000. The counties of the state paid $20,000 in 1914 and this year will pay more than $45,000 to their retired employees. The towns of the commonwealth paid out $15,000 in 1914 and will this year exceed $40,000 in pension payments.

Salary increases aggregating $62,876 have been allowed 563 men and women city employees by Mayor Peters in the 1921-22 municipal budget.

The mayor directed the department heads to give increases this year only where gross injustice existed or where the automatic $100 increase was provided.

The Public Works Department, the city's largest business branch, carries the largest number of increases—a total of 215, involving the sum of $23,000. The Health Department has 70 aggregating, $7,350; City Hospital 60, aggregating $10,212; Park Department 36, aggregating $4,275, and Institutions Department 25, aggregating $3,714.

Good Roads and Literacy

Many factors contribute to the illiteracy of a state or county, but it has been found that one of the most important is the condition of the highways.

Where the roads are good the schools are more generally made use of and the intelligence of the community is higher. In Arkansas, Mississippi, Missouri and North Carolina, where less than 2% of the roads are improved, is found an unusually high percentage of illiterates. In Massachusetts, Connecticut, New Jersey and Rhode Island, where 30% of the roads are improved, there is a very small percentage of the population which can be classed as illiterate.

Feard County, Texas, will vote on a proposed road and issue of $150,000 on May 7. If the bond issue passes the proceeds will be used with federal aid funds to build two bridges and several sections of road.

Norfolk County, Virginia, has a road budget of $201,177 for the coming year. In order to raise this amount the road levy has been increased to 5 mills. Last year the county spent $181,176 on road work.

Tulsa County, Oklahoma, has built 25 mi. of concrete highways in the past two years. The highway program of the county calls for the construction of 43 mi. more.

The North Dakota Good Roads Association is now publishing a magazine to stimulate interest in that state for better roads.

Madison County, Alabama, recently voted a road bond issue of $200,000. The vote cast was 2,076 for and 161 against.

MEETINGS

Calendar of Coming Meetings

June 20-24—American Society for Testing Materials—Twenty-fourth annual meeting, Asbury Park, N. J. Secretary, C. L. Warwick, Engineer's Club Bldg., Philadelphia, Pa.

June 28-July 1.—Society for the Promotion of Engineering Education—Annual convention, New Haven, Conn. Secretary, H. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

PERSONAL MENTION

John B. Fik has been appointed city engineer of Muskegon, Mich.

J. B. McKee was recently appointed city engineer of Plattsmouth, Neb.

W. C. Jepson has been appointed city engineer of Niagara Falls, Ont., Can.

Charles Schultz was recently appointed city engineer of McKinney, Tex.

W. H. Houser was recently appointed city engineer of Blue Springs, Neb.

B. A. Dockery has been appointed county engineer of Grundy County, Missouri.

August Pfafflin has resigned as county surveyor of Vanderburgh County, Indiana.

Peter Robertson has resigned as road superintendent of Lincoln County, Ontario, Can.

S. D. Dell has been appointed attorney for the Georgia State Highway Department.

H. G. Bailey has been appointed highway engineer of Henderson County, North Carolina.

W. J. Dwyer has been appointed superintendent of highways of Cortland County, New York.

Frank N. Rutherford has been appointed road superintendent of Lincoln County, Ontario, Can.

George C. Wright has been appointed superintendent of highways of Monroe County, New York.

Lang & Ross, of Sault Ste. Marie, Ont., have been appointed engineers of MacDonald and Meredith Townships, Ont., Canada.

H. G. Schulde has been appointed district engineer by the Pennsylvania State Highway Department, with headquarters at Bedford.

OBITUARY

T. L. Smith, founder of the T. L. Smith Co., died on April 29 in his home in Milwaukee, Wis. Mr. Smith was born in England in 1855 and after coming to this country, graduated from Iowa State College in 1877 with high honors, although he never attended high school. In 1899 he invented the Smith tilting mixer and with $500 of assets he built up the company bearing his name which now has assets of over $1,000,000. Mr. Smith also developed the Sterling Wheelbarrow Co.

Alfred E. Burke, a member of the Delaware River Bridge Commission of Pennsylvania, died at his home in Philadelphia from sciatic rheumatism.

Wasco County, Oregon, will vote upon a proposed $800,000 road bond issue on May 15. Of this sum, $625,000 will be spent on the Dalles-California Highway and the remainder will be apportioned to various sections of the county.

At a meeting in Crockett, Tex., business men subscribed enough funds to improve the highway between Crockett, Kennard and Ratcliff. This action was taken because the railroad between Lufkin and Kennard has suspended operation.

The City of Wilmington, Del., has sold $450,000 of street bonds bearing 4 ½% interest at 90.42, a figure considerably lower than the selling price of $300,000 of city bonds sold several months ago.

Road Bids in South Dakota are about 35% less this year than last, according to the State Highway Commission. A greater number of bidders are in the field and the bids submitted do not vary greatly.

A Bridge in Butte County, South Dakota, crossing the Moreau River and consisting of three spans, has been stolen. Sheriff Lefres of the county has arrested four men who are charged with the theft.

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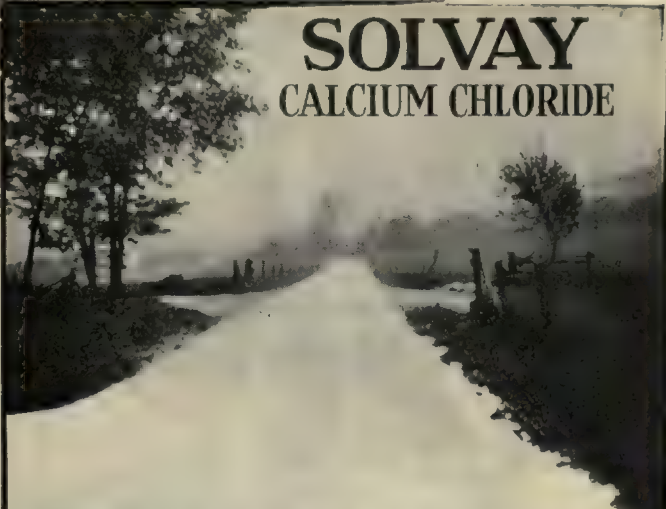

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GOOD ROADS
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New Roads For Old

By W. L. HEMPELMANN*

At various times cases are given of attempts to surface-treat old brick or block pavements. The thought generally is to produce a smooth surface, eliminate the noise, and last but not least, obtain a $2.50 pavement for considerably less than 50ct. per square yard. The temptation to get something for nothing prevails in the paving field just as well as in other commercial lines.

Irrespective of one's experience in paving matters, a moment's reflection will convince the individual of the impossibility of building the equivalent of a sheet asphalt or asphaltic concrete wearing surface over an old brick or concrete pavement by simply applying a little road oil and covering same with sand or stone chips. On the other hand, under favorable conditions, the surface-treatment of certain types of roads has been very successful.

In the South, certain hard roads constructed with coquina rock, shell, limestone, etc. have been very satisfactorily surfaced by an application of an asphaltic oil covered with hard stone chips. The surface of such roads when dry is more or less porous and absorbent and such treatment makes a very smooth, economical road surface, free from dust, and easy to maintain.

In the larger cities it is generally looked upon as an economical procedure, where the physical conditions of the pavements permit, to resurface old brick or block pavement either with binder and top or with an asphaltic concrete wearing surface. One reason is that the traffic in such communities in the main is heavier, the service to be rendered correspondingly greater, and usually the product of an asphalt mixing plant is available.

In the smaller cities the general tendency is to try to get away from the use of what is termed "expensive equipment." This tends to put the official in charge in a receptive mood to consider the surface-treatment of his rough pavements with a certain material. Generally the conversation relative

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*Engineer, Asphalt Sales Dept., The Texas Co.

SPREADING BINDER COURSE ON OLD PAVEMENT BEFORE LAYING ASPHALT SURFACING

CLEANING OUT DEPRESSION IN BRICK PAVEMENT BEFORE FILLING WITH ASPHALT BINDER to the procedure is about as follows: "All you have to do is to clean the street, apply the bituminous material liberally, and cover with chips."

The simplicity appeals to the engineer in charge and in the majority of cases, with no experience to the contrary, he agrees to try it out. Within three or four months after such treatment such engineer desires to give his fellow engineers the benefit of his "discovery" and accordingly he writes an article. Usually after such treatment has gone through a winter and a spring there are considerable areas that have scaled off of others in which the materials has been displaced by traffic. The representative who volunteered the construction information either hears about the results or accidentally happens into the city once after he has made the sale of the original material. His reception by said engineer can be better imagined than described.

The fallacy of surface-treatment of old worn brick or block pavements comes in not being able to provide a uniform depth of wearing surface of uniform density throughout. When we undertake to resurface a brick pavement we are very careful to fill or cushion all depressions even prior to the application of the binder course under a sheet asphalt wearing surface. One of the reasons for this procedure is to insure a uniform density throughout the depth of the asphaltic covering whether in the low spots it be 5 or 6 in. or only 3 in. over the high brick.

One of the main points to be borne in mind in the consideration of resurfacing old worn brick or concrete pavements is that the minimum depth of asphaltic surfaces (i. e. the material over the high points in the old brick pavement) must be such as to be able to absorb the shock of traffic without shattering or disintegrating the upper surface of the old pavement. The malleable asphalt must be thick enough to practically absorb the impact of heavy loads at high speed. If this condition does not obtain, traffic may shatter the upper surface of the old brick or concrete and though the asphaltic mixture adheres to the material with which it is in contact such wearing surface will begin to peel or come off taking with it a thin irregular layer of the concrete or brick surface.

When the wearing surface over an old rough brick or concrete pavement is to be asphaltic concrete mixture we still cushion or fill the depressions and all low places in the old pavement before applying the asphaltic concrete wearing surface. Sometimes the advocates of the surface-treating process of brick pavements will suggest that the larger holes be filled in with stone prior to the general surface-treatment of the street, but in any case it is impossible to obtain a uniform depth of bituminous material and stone to serve as a wearing surface.

Under traffic, as outlined above, with an insufficient depth of uniformly dense asphaltic wearing surface, the high spots in the old brick pavement soon cut through the bituminous material and make possible the absorption of water at such points. Old brick pavements that have been subjected to the use of steel-tired traffic are water absorptive and this fact permits moisture to get under the bituminous material. Subsequently, the warming up of the pavement due to the sun's rays brings such moisture to the surface of the brick, i. e., under the bituminous surfacing material. This condition tends to destroy the bond between the bituminous material and the brick and usually can be considered as a factor in helping to cause the surface-treatment to scale off. Usually the average consolidated depth of such surface-treatment (bituminous material and aggregate) is less than ½ in. How many experienced engineers familiar with standard sheet asphalt and asphaltic concrete construction would advocate ½ in. or less of sheet asphalt or asphaltic concrete as a covering for an old and irregular brick pavement? Still, the inexperienced official is willing to try out the surface-treatment with stone as the covering material, the various operations of which must produce a mixture on the old pavement which is anything but uniform.

To cover satisfactorily an old brick or block pavement the minimum depth of the bituminous wearing surface applied must be sufficient to withstand the shock of traffic and must be uniformly dense so as not to be displaced by traffic. Naturally this cannot be done by a wearing surface usually less than ½ in. thick on the average. Under very light traffic in small cities such treatments may go through a season without becoming an eye sore but usually streets of that nature are not surface-treated simply because the demand of traffic does not warrant the expense. In any case, the attempted surface-treatment of brick or block pavements irrespective of how carefully the work may be done generally leads to grief and if attempted will subsequently bring up the same job either for reconstruction or resurfacing with sheet asphalt or asphaltic concrete in a relatively short time. The expense of the surface-treatment is usually considered wasted or charged to "valuable experience."

Minnesota's Road Program

Under the Babcock amendment, adopted at the last general election in Minnesota and passed by the legislature during its recent session, the state enters upon a great road building program. Improvements will be financed with the proceeds of a 2% tax on the list price of motor vehicles, in lieu of other levies, a state advalorem tax of 1% and local levies.

A maintenance force of 1,000 men has been organized, with a patrolman for each 5 mi. section, supplemented by special repair gangs. It is planned to spend about $10,000,000 this year for road construction and maintenance.

Organizing a Road Job for Mechanical Hauling of Material*

By C. D. CURTIS†

The last few years of the last decade ushered in a new era in road building. Legislative action stimulated in a large measure by the Federal Aid Road Act has been taken in practically every state, making possible the inauguration of an unprecedented country-wide program of highway improvement. The rapid expansion of the use of the motor vehicle has created an insistent and growing demand for more and better highways. It so happens that this movement has had its greatest growth during a period of rising costs, the crest of which has only recently been passed; so that, along with the urge for more and better highways, there has been always in the mind of the highway engineer the necessity for rigid economy of labor and effort. Fortunately, the inventive genius of the country has not been idle during this period and many new and improved types of road machinery and equipment have been put on the market. The introduction of this new equipment has made it possible to perform mechanically many of the operations connected with road building not only cheaper but better than by the older hand methods.

While every one will concede that all construction jobs should be carefully planned and well organized for the handling of materials, it must be admitted that this is not always done. In the past too little thought and study have been given to this preliminary phase of the work. Until recently, however, road work has been handled on a comparatively small scale, and the cheaper types of construction prevailed. An extensive plant was not required and the evolution brought about by the general adoption of higher types of construction and the growth of construction programs is still under way. It is unfortunate, but nevertheless a fact, that most jobs are equipped without giving to their planning and organization a proper amount of careful study. As a result expected profits shrink and may even become actual losses. Improperly equipped jobs can be classified under three heads:

1 Too much plant,

2 Lack of plant, and

3 Unbalanced plant.

With too much plant on a job the efficiency of operation is lowered, and although fairly satisfactory progress may be made, the cost will be too high. Rental or interest on investment and depreciation charges continue regardless of output. On an underequipped job it is necessary to resort to labor which may be less efficient and more expensive. The progress of the work is likely to be delayed and total costs increased.

Of all the improperly equipped jobs the ones that have an unballanced plant are probably most common. They are the inevitable result of equipping without planning. The several units making up the plant may be efficient mechanically when considered alone, but totally incapable of being worked smoothly and continuously together. On such jobs efficient operation cannot be secured. The plant investment might, and probably would, be lighter than for a balanced plant. The season's profits, however, are certain to be lower than anticipated.

Classification of Road-Building Work Based on Desirable and Practicable Rate of Progress

In the author's opinion a classification of road-construction jobs based on the desirable and practicable rate of progress is feasible and would aid the contractor or engineer in selecting the proper plant. In determing on such a classification several factors would enter into consideration, chief of which would be the size or length of the project. Another factor would be the problem of satisfactory detours and the probable economic loss to traffic. The cost, of course, would be affected by the classification. Ordinarily a higher rate of progress would be required on a large job than on a small one. The extra cost, then, of assembling and operating a large plant capable of rapid progress would be spread over a large yardage. It might easily happen, however, that the economic conditions would warrant requiring very rapid progress on a comparatively small job. This would change the classification and increase the cost of the work, but the bidder would know just what to expect.

In connection with concrete-road jobs there might be three classes, such as:

A—Jobs on which equipment with a daily capacity of 1000 ft. of 18-ft. roadway would be required;

B—Jobs on which equipment with a daily capacity of 500 ft. of 18-ft. roadway would be required, and

C—Jobs on which equipment with a daily capacity of 250 ft. of 18-ft. roadway would be required.

In the case of Class A jobs it would ordinarily be desirable to equip with at least two complete operating units. This would insure continued, even though retarded, progress in the event of a breakdown of one unit.

Such operations would, of course, be contingent on the weather and other conditions beyond the contractor's control, but the classification would give a more definite idea of the requirements and enable the engineer and all bidders to estimate on the same basis. The classification conditions should be covered in the specifications.

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*Paper presented at spring meeting of American Society of Mechanical Engineers.

†Assistant to Chief, U. S. Bureau of Public Roads.

Necessary Limitations Imposed by Specifications

Unnecessary refinements in the specifications which are met with at times usually lead to difficulties in operation and should, in the author's opinion, be avoided, especially where enforcement increases the cost of operation for minor or questionable benefits. There are, however, certain limitations which make necessary an intimate knowledge of the specifications under which work is to be performed. Examples of these limitations are:

1. Time limit on depositing of concrete after mixing. This limit would have a direct bearing on the location of central mixing plants and the equipment required for handling both the aggregate and the concrete.

2. Definite requirements relative to concrete mixers such as water-measuring advices, boom and bottom-dumping buckets, etc. Such requirements are small details, but must be met and so must be considered in selecting equipment.

3. Materials for concrete not allowed on subgrade. This feature is very important and makes necessary a careful study of the project in the field. Several alternative methods of handling the materials may be possible, and the most economical and efficient one can only be determined after a consideration of all the conditions. One location might be well adapted to the use of industrial-railway equipment, while in another location this method might be entirely impracticable and hauling of proportioned batches of aggregate and cement in trucks the most feasible. The central-mixing-plant method might be the proper selection in some other location. In the case of a large job conditions may vary considerably on different sections of the same job.

Precautions to be Taken in Selecting Equipment

In selecting equipment for a project, everything bearing on the situation should be considered. The source of materials to be used, whether local or imported, condition of roads to haul over, width of available right of way, trackage and storage facilities available at receiving points for materials requiring rail transportation, maximum grades, water supply, availability of common labor and teams, and length of working season are some of the factors which should be looked into and studied before deciding on the type of plant to be used. In this connection the engineer may and should render all possible aid to the contractors. The preliminary investigations and detailed surveys made by the engineer give him much more information than the contractor can secure readily in his preliminary field inspection of the project. If the engineer knows that the conditions, even though not apparent, make the use of certain types of material impracticable, this information should be given to the contractor.

A feature which perhaps is not germane to this discussion but which is very important and deserves a few words, is the desirability of considering the source of the materials to be used with respect to the possibility of continuous rail-transportation service. Without a reasonable assurance of a continuous supply of materials throughout the working season, an elaborate plant layout may become much more of a liability than an asset. By arranging to ship and store materials during the season of light demand for open-top cars, for use during periods of car shortage, a continuous supply of materials can be secured. Such an arrangement may considerably alter the selection of equipment for handling the material. Strong arguments may be made against the plan of advance storage of materials in states where estimates for materials delivered are not allowed, but the extra cost of storing materials may be more than offset by the gain due to continuous operation during the construction season.

It is desirable, of course, when possible, to avoid all unnecessary rehandling of materials. Where the materials can be unloaded from cars or loaded from the quarry or pit directly into containers for transportation to the job and in addition can be deposited in the mixer, in the case of concrete, without touching the ground, a great advantage is gained. In addition to being kept clean and free from mixture with foreign matter, the item of waste is very greatly reduced.

Exclusive Development of Large Individual Units Undesirable

In some states, by adopting the practice of letting large contracts for long stretches of construction work, large contracting companies have been induced to enter the highway field. They have brought trained operating organizations to the work and have put expensive road-building plants on their jobs. There is wisdom in such procedure whenever possible, for, of necessity, a great many road jobs are and will continue, for a variety of reasons, to be of comparatively short length. Letting contracts in both large and small sections gives both the small contractor and the large a field of operation and greatly expedites the carrying forward of a large program. The small contractor, acting as his own superintendent and operating with but little mechanical equipment, has but little overhead and can compete on a small job with the large contractor operating a large plant and carrying heavy overhead expenses.

Road building differs from most other construction activities in that the operations are conducted along an extended narrow path. The failure of one link may interrupt the work of a whole operating chain. This fact, in the author's opinion, makes the present tendency toward the development of large individual units somewhat questionable. When a large unit is

(Continued on page 292)

Justifiable Highway Bridge Costs*

By P. BURKE GAFFNEY†

Canada will spend upwards of $100,000,000 in the next five years in the construction of good roads, and probably 25% of that, or $25,000,000 will be spent on bridges. In the expenditure of such a large sum of money there is ample opportunity for waste, and ample scope for economy. It might be wise, therefore, to review the principles governing the economics of highway bridge construction.

There are certain governing factors to be established which are universally applicable to all bridges within a special area, such as loads to be carried and width of roadway, before discussing the economic principle applicable to individual bridges. The construction of a bridge is a business proposition and should be treated as such. The authorities directly charged with its construction are the directors of a corporation dedicated to that purpose, while those who pay are the shareholders. It is the duty of the directors to invest the shareholder's money to the greatest possible advantage to secure the maximum possible return, that return taking the form of a service to the community as a whole. The most vital element in any business corporation, economists tell us, is organization; and while the organization for the purpose of bridge building is established in most centers, it has been established for conditions different from those which exist now and which will exist during the road building period of the next few years. It might be said that we are entering an era of large scale production and that the organization suitable for the production of a unit may not be economical for the production of a number of units. It must be admitted that under existing conditions the construction of well defined systems of road and bridges thereon by provincial highway and bridge departments is the most economical. The provincial bridge engineer should be the sole arbiter of the location, type, design, construction and all other details appertaining to the structure and should carry the undivided responsibility.

A highway bridge has two functions. It permits a stream to flow under a road and it carries traffic over the stream. To perform the first function most economically the bridge should be just long enough to take care of the maximum flow without damage to the structure or interference with traffic, and no more. To determine the requisite length involves the study and measurement of the stream flow, and a department dedicated to highway bridge construction should at the outset prepare a map of the territory within the limits of its jurisdiction showing the drainage area of all streams, with their salient characteristics. It will be found that the territory can be blocked off into areas within which there is uniformity of rainfall, soil character, slope, vegetation and other factors governing stream flow, and after a little observation general formula connecting drainage area and flow can be established for these areas. In this manner the requisite area of waterway can be more quickly and more scientifically obtained.

The study of traffic to be taken care of presents a rather more difficult problem, for it is not a natural phenomeon. Writers of ten years ago made the statement that we might reasonably expect and should take into account, when designing, motor truck loads up to 40 tons. We know that no such loads will ever come on roads, because we could not afford to build roads to withstand them. The tendency is to fly to the other extreme and say that the peak as regards concentrations is over and that future development will be toward lighter and faster moving traffic. This may seem as absurb ten years from now as the statements of ten years ago seem today.

Two factors stand out prominently in reviewing this situation. One is that with the improvement of roads, there is a tendency to increase the size and speed of loads until the roads begin to deteriorate. Most of our roads have been built with long term bond issues, and in a great many cases the road is utterly ruined through the increase in traffic before it is fully paid for. Nothing could be more uneconomical or bring discredit more rapidly on the good roads movement than a condition such as this. The only solution appears to be to design roads for a certain load and to create legislation prohibiting any load on the road not conforming to an established specification. This would determine once and for all the load for which a bridge should be designed, and it would appear to be merely a matter of common business acumen to establish definitely such loading before undertaking large scale construction.

The second factor is with the improvement of roads to equalize the weights of bridges. Now we distinguish between the loads carried by urban and rural bridges. In the future the only distinction between urban and rural bridges will be in the width of roadway, for the wheel concentrations will or ought to be limited and the difference will lie in density of traffic. To establish the minimum width of roadway, it may be said that the roadway on a bridge of ordinary length without street-car tracks should be wide enough to take care of two continuous lines of fast moving traffic in safety. This width has been fairly well established at 20 ft. and there seems to be no good reason why any bridge under about 200 ft. span not subjected to city traffic should be any wider. Twenty feet is sufficiently wide to provide clearance for any single load, and loads of such a width as will not permit an automobile to pass on a 20 ft. roadway are of such comparatively rare occurrence that there is no justification for spending a large amount of money in making provisions for them.

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*Paper presented at eighth annual convention of Canadian Good Roads Association, Halifax, Canada, May 10-12, 1921.

†Bridge engineer, Manitoba Good Roads Department.

The loading and width of bridges having been established and provisions having been made for the minimum necessary waterway, any particular bridge problem involves the following considerations: permissible amount of investment; relative costs of various types; provision of pleasing appearance.

As already pointed out, the construction of a bridge is a commercial undertaking, and as such is subject to the universal canon, "will it pay?" For an industrial enterprise, this question can usually be answered and a margin of profit actually determined for. In such a venture, the state of receptivity of the market for the particular product is investigated, what is usually termed "the demand," and the cost of production being known, it is a comparatively simple matter to decide the scale upon which operations may be conducted economically. The revenues of a bridge are, however, for the most part intangible. The only absolute method of determining the permissible amount of investment would be, were it possible, to translate the service rendered by the bridge during its lifetime into dollars and cents, to capitalize the named income at a fair rate of interest and thus arrive at the value of the investment. This is seldom possible to determine accurately. But frequently a very fair approximation can be made in locations where no bridge exists by establishing the boundaries of the "traffic area" (analgous to drainage area), and finding the distance saved by the construction of a bridge between the centroid of the traffic area and the objective of the traffic. Where it is a question of replacement, the amount of investment permissible is generally fairly easily determined, for it can be measured by the capitalized cost of maintaining the old structure, but even then there are intangible factors such as the risk due to accident, which are difficult to express in terms of dollars.

Availability of funds is frequently given as the first and most important consideration in selecting a type of bridge, whereas it should never be taken into consideration at all, except in so far as to decide as between building a bridge and not building a bridge. There is but one most economic type of bridge for any given site and if funds are not available for that, the investment should not be made.

In making a comparison of the relative cost of various types, comparison should be made between not only first costs but total costs. The total cost includes first cost, capitalized cost of maintenance, operation, repairs and replacement figured on the probable life of the structure. It should also properly include the capitalized cost of insurance against fire and accident. In view of these considerations it is evident that timber bridges should not be constructed except as a development project in a sparsely settled region where the construction of a permanent bridge would impose on the community a load that it would be unable to bear.

It is almost impossible to predicate any rules of general application in comparing the various types of permanent construction; local economics will generally give the deciding factor. The following points, however, will necessarily have to be considered: proximity of building materials; length of haul from shipping point; nature of foundations; variation between high and low water; danger from ice; log jam or scour; amount of grading. The longer the clear span, the worse the foundations and the closer to a shipping point, the more favorable conditions will be for steel construction. On the other hand, concrete will prove more economical in locations where good gravel can be obtained close at hand, and the distance for hauling structural materials is relatively long. Concrete bridges also are better able to withstand floods and unusual atmospheric conditions. Another point deserving of consideration is that non-union labor enters more largely into the cost of concrete than steel bridges.

The question of concrete or timber floors on steel bridges depends on the life of the timber floor which depends on the nature and intensity of the traffic to which the floor is subjected. A concrete deck adds little or nothing to the cost of the substructure, and whether the cost of concrete in the floor and additional steel in the trusses is ultimately cheaper than the original cost of the timber and the cost of maintenance, repairs and replacement of the timber floor is determined altogether by local traffic conditions for each individual case.

The provision of pleasing appearance is a factor which is too frequently relegated to the background and considered of subsidiary importance in studying the economics of bridge construction. In building a system of national highways, the arteries of our social and economic existence, art is an essential as mere strength and utility.

There is a popular but widely spread misconception that art is an adventitious adornment on the more or less superficial amenities of social existence, a dispensable luxury, pleasant enough when there is ample wealth and leisure, but of no value until the serious business of life is fulfilled. We know that it is not so; we know that art is the expression of emotion, and that emotion is the energy of life. The function of reason is merely regulative among de-

(Concluded on Page 292)

GOOD ROADS

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Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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Vol. XXI JUNE 1, 1921 No. 22

THE TOWNSEND BILL

Appearing before the Senate Committee on Post Offices and Post Roads to oppose the passage of the Townsend Bill, Thomas H. MacDonald, Chief of the U. S. Bureau of Public Roads, submitted several provisions to be incorporated in federal aid legislation. These recommendations are: increased compensation to federal highway engineers; classification of federal aid roads, with the states retaining the initiative in the selection of these roads; the meeting of federal funds with state funds; the maintenance of federal aid roads, and the installation of a system to train men similar to that now followed in France.

"A policy of self-determination," said Mr. MacDonald in speaking for the present system of federal aid, "is the policy which has been adopted by the Government in a large way. This to me is the big important question in this whole matter—that the efforts of the Federal Government should assist in developing matters primarily of local importance but which, in the aggregate, have a tremendous influence upon the national life. The form of legislation has recognized the necessity of reconciling the conflicting claims of the advocates of state rights and of those in favor of centralization in matters which affect, first of all, the locality and afterward the nation as a whole."

Thus does Mr. MacDonald point out the principles on which any federal aid legislation should be based. The states in furnishing at least half of the funds with which to improve federal aid roads, should be allowed to determine what roads should be improved, subject to review by the Government. The assumption on the part of the Federal Government of the exclusive rights of prescribing routes, road widths, types of pavement, etc., the states bearing half the cost, is directly opposed to the policy of self determination.

Highways and railroads are not primarily of national importance—neither is any other element of the commercial and industrial fabric. Except for through tourist traffic, most vehicles operate within a radius of about 200 mi. Naturally, the most important roads would not necessarily form a continuous route across the country. Yet the roads which carry this traffic are of national as well as of local importance. A few years ago the motor truck carried very little tonnage; now it carries half as much tonnage as carried by the railroads; ten years from now it will carry more tonnage than will the railroads. Surely this traffic is of national importance, yet it is all traffic of a comparatively small radius. Hence it is possible to improve roads of primarily local importance, the sum of the benefits of which would be greater than the benefits derived from the construction of a necessarily limited "system of national highways," as provided in the Townsend Bill.

NEW ROADS FOR OLD

As was the woman in the fable of Aladdin tempted by the cry, "New lamps for old," so have some road builders been tempted by the cry, "New roads for old." As pointed out in an article appearing elsewhere in this issue: "At various times cases are given of attempts to surface-treat old brick or block pavements. The thought generally is to produce a smooth surface, eliminate the noise, and last but not least, obtain $2.50 pavement for considerably less than 50 ct. per square yard."

While in a great many cases old pavements make ideal foundations for new pavements, the mere sweeping of the old surface is insufficient to insure a successful new pavement. Because of the unevenness of a worn pavement, whether it be macadam, brick or other material, it is necessary to eliminate depressions so that a minimum depth of new surfacing will exist throughout the roadway. If at one or more places the thickness of the new surfacing is such as will not stand up under traffic, the way is opened for disintegration of the pavement.

The salvaging of old pavements is of growing importance, for often a serviceable road can be obtained with relatively small expenditure by resurfacing an old pavement. And because of this fact, the word of caution contained in the article mentioned above is of considerable importance.

Organizing a Road Job for Mechanical Hauling of Material

(Concluded from page 288)

used every precaution should be taken to insure its continuous operation.

One of the greatest handicaps which the road builder encounters in the northern states is the short construction season. Continuous operation is impossible and each season it is necessary to organize new construction forces. It takes some little time to organize a new outfit so that the work will proceed satisfactorily. In the case of the skilled mechanic and foreman, an attempt should be made to retain their service the year around. They can be utilized during the winter in repairing equipment and putting it in first-class condition for the next season's work. It may even be necessary to furlough them for a time with pay, but the investment will bring big returns in added loyalty to the company and increased devotion to duty. The average man appreciates a square deal and will show it in increased efficiency. The use of an extensive plant requires skilled operators, and, once trained, their services should be retained. Efficiency of operation in road work depends on the proper functioning of all the separate units. The mechanical units function properly only when properly handled.

On large jobs where more than one plant or complete operating unit is used, the spirit of the organization can be kept up by introducing friendly competition. The rivalry between two outfits to reduce costs and increase yardage has a very healthful effect on progress and incidentally on profits. The author recalls a bituminous-concrete construction project on which four separate mixing plants were used. One of the plants was an old, makeshift affair, but was handled by an energetic superintendent who had old and loyal employees of the company as foremen and mechanics. The output and costs compared more than favorably with the new plants, due entirely to the better morale of the men. It pays to retain loyal and efficient employees.

Justifiable Highway Bridge Costs

(Concluded from page 290)

sires giving direction and control; there is no man who ever accomplished anything who did not love something, hate something or desire something. Schiller says, "It is therefore not going far enough to say that the light of the understanding only deserves respect when it reacts on the character; to a certain extent it is from the character this light proceeds; for the road that terminates on the head must pass through the heart. Accordingly the most pressing need of the present time is to educate the sensibility because it is the means not only to render efficacious in practice the improvement of ideas, but to call this improvement into existence."

Appeal through the sense of vision is the simplest, because it can be made without knowledge of the subject, it can be made without active consent. The sight of an artistic bridge, for example, creates an emotional reaction making the mind more susceptible to an appreciation of the beautiful, whether in nature or art. There can be no doubt that the sight of a beautiful object has a psychological effect which directly contributes to greater efficiency. It tends to create an emotional mood; an emotional mood stimulates the whole organism, the bodily phase as well as the spiritual and mental. The result is an increased ability to think and to do.

Wisconsin Will Experiment With Gravel Roads

Tests will be conducted by Wisconsin on gravel roads to determine to what extent they will stand up under heavy traffic. A few miles of gravel road will be constructed near Madison by the State Highway Department and it is planned to compile definite data as to the durability of this type of pavement when subjected to heavy traffic.

"The gravel road," says A. R. Hirst, State Highway Engineer, "has increased in favor, but there is not yet sufficient data upon it to determine how it will stand heavy traffic. The piece of road selected to test it out is an extremely heavily traveled road and is located convienently for observation by the department's engineers."

Oklahoma County, Oklahoma, Fails To Sell Road Bonds

Although the State of Oklahoma this year passed a special law permitting Oklahoma county to market a $750,000 road bond issue, the county has not sold its bonds. Seven bids were recently received on the bonds, all at 93, the minimum price allowed by the special law. These bids were rejected because of the conditions attached to them, according to J. N. Abernathy, Chairman of the Board of County Commissioners.

Pennsylvania Passes Gasoline Tax Law

On May 22 Governor Sproul signed the Dawson Bill, which places a tax of 1c a gallon on gasoline sold in the state. This law will go into effect on Sept. 1. Half of the moneys collected will be returned to the counties where originating, to be used for road work.

Motorists Sue Road Contractor

Alleging that insufficient barricades and danger signals were provided along the highway under construction, three suits have been filed against Peter F. Connelly, a contractor, who was constructing a road in Beaver County, Pennsylvania.

Material Handling to be Studied by American Society of Mechanical Engineers

The handling of materials, as distinguished from their transportation, is to be studied by the American Society of Mechanical Engineers through a committee established for that purpose.

According to a recent announcement by the society, its Materials Handling Division has decided upon its general program, and in order to carry it out has divided the work between two committees, one on equipment and the other on industries. The announcement continues as follows:

"The definition of 'materials handling' which it has adopted limits to secondary transfer—as distinct from transportation by railroad, highway trucking, steamship, etc.—the 'picking up and putting down' of materials in production and the linkages between common carrier and the user."

As a part of its program, the division is sending out questionnaires to various societies to ascertain what investigations are being made by other organizations and whether or not data obtained in such studies will be available to the division's investigators.

Japanese Road Maker Studies American Highways

Prof. T. Takakuwa of Kiriu University, Tokio, Japan, sent abroad to study highways in Europe and the United States, will leave for Tokio early in June. Prof. Takakuwa inspected the streets in many of the large cities in the East and Middle West and made a number of tours through the rural sections of New York, Pennsylvania, New Jersey, Massachusetts and Illinois.

"The City of Tokio," said Prof. Takakuwa, "is going to lay down new pavements throughout the city and will probably commence the work this spring. The City of Osaka, which is the largest business and industrial city next to Tokio, and the other principal cities will also start paving work in the near future, possibly this year. Accordingly, the paving enterprise is growing rapidly in Japan and will develop into a big business in the future."

Wilmington Will Spend $500,000 For Street Paving

The City Council of Wilmington, Del., on May 2 passed an ordinance authorizing a bond issue of $500,000 for street paving. The ordinance provides for the repaving of South Broome Street, between Lancaster and Maryland Avenues; East Fourth Street, between Market Street and Christiana Street; West Fourth Street, between Adams and Union Streets; King Street, between Front and Sixteenth Streets; Washington Street, between Eleventh Street and the bridge; Heald Street, between Christiana and Lobell Streets.

Hearings Held On Townsend Bill

Thomas H. MacDonald, Chief of U.S. Bureau of Public Roads, Opposes Bill Vigorously

While much of the testimony which has been given at hearings on the Townsend bill has been in favor of the proposed measure, a number of men prominent in road building circles have appeared before the Senate Committee on Post Offices and Post Roads to oppose the measure. In addition to those appearing before the committee previously reported in this journal, General Pershing; Roy D. Chapin, President of the Hudson Motor Car Co.; C. R. Berry, Assistant General Freight Agent of the Chicago, Great Western R. R.; G. S. Hoag, Field Secretary of the Lincoln Highway Assn.; Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads, and others have appeared. With the exception of Mr. MacDonald, the above men were of the opinion that federal funds for road building could be administered best by a federal highway commission.

Mr. MacDonald stated that the Federal Government should assist in "developing matters primarily of local interest, but which, in the aggregate, have a tremendous influence upon the national life," saying that the following principles should be included in any new federal aid legislation:

"Adequate provision should be made for securing and retaining the services of men best qualified in highway engineering and administration. To do this it is necessary to increase by a considerable margin the salaries now paid in the federal organization. The salaries now paid are below the scale paid in many of the states.

"Provision should be made for the classification of federal aid roads in each state under systems of like or equal importance. The state should retain the initiative in the selection of these roads, but the federal authority should be given to review and modify the selection.

"Federal funds for construction should be met by state funds.

"Roads built with federal aid should be maintained.

"The federal administration should be given authority to train men in a manner similar to that now followed in France. The whole matter of highway organization and administration is a matter of trained personnel."

Commercial vehicles in England past nearly one-half of the motor taxes in that country.

Cumberland County, Maryland, has a road budget of $132,632, according to Douglas P. LeFevre, County Road Engineer.

Guilford County, North Carolina, will construct 31 mi. of road this season, according to W. C. Boren, Chairman of the Guilford Highway Commission.

EQUIPMENT -- TRADE -- MATERIALS

Suggestions For Asphalt Paving Contractors

Brochure No. 13 bearing the above title has been issued by the Asphalt Association, New York City. This booklet contains 26 pages and is devoted to the consideration of the proper use of equipment in asphalt work and the proper organization of the work. Among the topics discussed are: loading plants; hauling equipment; mixing plants; crushing equipment; rolling equipment; organization and planning of jobs.

Granite Block Pavement With Asphalt Filler In Cincinnati

Hamilton Avenue, Cincinnati, O., carries the bulk of the traffic entering the city from the north, and when it was recently decided to repave the street, Frank Krug selected granite block with asphalt filler. In the construction of the pavement, a foundation of 7 in. of 1:3:6 concrete was laid on a thoroughly compacted and well drained subgrade. Then a bed of 1¼ in. of clean, coarse sand, free from pebbles over ⅜ in. was laid, on which were placed the blocks, averaging about 32 to the square yard. The joints of the pavement were filled with asphalt filler and clean dry pebbles passing a ½ in. screen and redrained on a 3-16 in. screen.

The pebbles were swept by hand into the joints in three operations, each application being followed with a hand application of asphaltic filler sufficient to fill the voids in the pebbles. The third application consisted of a flush coat over the entire surface, filling all joints and leaving a light coat of asphalt on the top of the blocks. A ¼ in. covering of dry pebbles passing the ¼ and detained on the ⅛ in. screen was spread on the surface and rolled with a tandem roller. The pavement was then opened to traffic. Hamilton Avenue is 40 ft. wide between curbs and in order not to close the street to traffic, half of the width was laid at a time.

VIEW OF WORK ON HAMILTON AVENUE, CINCINNATI, O., SHOWING LAYING OF BLOCK AND APPLICATION OF TEXACO ASPHALT FILLER

New Pavement Breaker

A new pavement breaker for removing all kinds of pavement has been placed upon the market by the Ingersoll-Rand Co., New York City. Because this pavement breaker is operated by compressed air, its use posesses several advantages over slow hand labor.

INGERSOLL-RAND PAVEMENT BREAKER

This breaker is similar in construction to the modern non-rotating type of hand hammer rock drill. It is extremely simple and rugged, being of all-steel, principally drop forgings. Two breakers may be operated by the compressed air furnished from one small portable gasoline or electric compressor. In order to secure a good grip by the operator, the breakers have dropped T-handles, sand-blasted. In the handle is incorporated a simple trigger throttle valve. The machine uses 1⅛ in. solid hexagon steel with collared shanks. A chisel edge steel is used for cutting asphalt, etc., and a moil point for cutting or spawling concrete, loosening paving stones, breaking up frozen or compact ground, etc.

Catalog Of Baker Equipment

A general catalog of the Baker line of road building and earth moving equipment has recently been issued. This booklet contains 48 pages and contains numerous illustrations of the various machines. Among the machines are the Baker-Manning self-loading scrapers; "Uncle Jim" self-operating road levelers; Baker road graders; "20 Century" snow plows, and motor truck snows. This equipment is manufactured by the Baker Manufacturing Co., Springfield, Ill.

New 3-Batch Industrial Car

An industrial railway car which carries three batch boxes has been placed upon the market by the Easton Car & Construction Co., of New York City. The boxes used are of the tip-over or bottom dump type, with capacities up to 35 cu. ft. each, or the car can be used with two of the large 54 cu. ft. boxes. In addition to the use of this car in carrying aggregates, it may be easily converted into a dump car for grading and filling by attaching a V-rocl body.

The under frame of the car is made of extra heavy channel steel, braced by gusset plates at the corners and a center cross tie. A steel plate platform at one end is provided for the brakeman. The brake is foot-operated and acts on all four wheels. The draft rigging consists of steel bull-nose bumper with link and pin couplings and double acting springs at both ends of the car, in a specially designed steel housing which acts as a cap for the center sill and which keeps waste out of the draft rigging. The bumpers have extra wide faces with cast steel guides and bumper plates which reinforce the center sill. The wheels are of extra heavy single plate type, pressed on special steel axels. The journal boxes are of the roller bearing type, oil and dust tight, with oil reservoir and operate in double spring pedestals, tied together across the car to prevent spreading from end thrust on curves.

EASTON THREE-BATCH CAR

Hercules Powder Company Absorbs Aetna Explosives Company

The stockholders of the Aetna Explosives Co. have sanctioned the sale of the company to the Hercules Powder Co., of Wilmington, Del. On May 4 the Circuit Court of Appeals, sitting as the U. S. Court for the District of Delaware, rendered a decision giving permission for the purchase of the Aetna company. With this purchase the Hercules company will acquire a number of plants in new territories and its service will be extended greatly.

California Highway Association Formed

The California Highway Association was recently incorporated for the purpose of promulgating information on highway improvement and to stimulate interest in better roads in that state. The incorporators of the association are Edward Fletcher of San Diego, President of the Dixie Highway Association; W. O. Russell of Davis, Chairman of the Board of Supervisors of Yolo County, and J. C. Havely, Chairman of the Sacramento County Highway Commission.

Contrary Signs

When Governor Small of Illinois and other state officials started on their inspection trip of Wisconsin roads recently, they passed over a bridge at Rockton, Ill., near the border. A Wisconsin banner of welcome to the Illinois officials was stretched across the bridge, a welcome rendered somewhat dubious by the legend appearing on the bridge. "Bridge Condemned, Cross at Your Own Risk."

American motor vehicle owners spend about $1,000,000,000 annually for 40,000,000 tires.

Bermuda is the only civilized country in the world from which automobiles are barred.

Menifee County, Kentucky, recently passed a $60,000 road bond issue by a vote of 6 to 1.

Merced County, California, has purchased $1,000,000 worth of state highway bonds.

Schnectady County, New York, is planning to spend more than $50,000 on road work this year.

St. Joseph County, Indiana, has sold $658,000 of road bonds bearing 6% interest at par with accrued interest.

The Camden Road Material Company, Camden, Tenn., has been organized with a capital of $75,000 and will engage in the production of sand and gravel.

The California State Highway Department failed to receive any bids on April 15 for the $3,000,000 of highway bonds offered for sale. The interest on these bonds was fixed at 5 ¼% by the recently created finance board.

MEETINGS

Calendar of Coming Meetings

June 20-24—American Society for Testing Materials—Twenty-fourth annual meeting, Asbury Park, N. J. Secretary, C. L. Warwick, Engineer's Club Bldg., Philadelphia, Pa.

June 28-July 1.—Society for the Promotion of Engineering Education—Annual convention, New Haven, Conn. Secretary, H. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Oct. 24-28—American Society for Municipal Improvements—Annual Convention, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

U. S. Bureau of Education

A conference on highway traffic regulation was held at Yale University on May 23 under the auspices of the Committee on Highway and Highway Transport Education of the U. S. Bureau of Education. The meeting was arranged by Prof. Charles J. Tilden, Director of the committee. Among the speakers were William P. Eno, Washington, D. C.; C. J. Bennett, State Highway Commissioner of Connecticut; A. N. Johnson, Dean of the engineering school of the University of Maryland; Harriet E. Beard, of the Detroit, Mich., Department of Education, and James W. Inches, Police Commissioner of Detroit, Mich.

Mr. Eno emphasized the value of rotary traffic at street intersections, saying that the present method of controlling traffic on Fifth Avenue of New York City is inefficient. The necessity of educating the public was also pointed out by Mr. Eno as being essential to traffic regulation.

Mr. Johnson spoke upon the need of taking traffic censuses. From extensive investigations, Mr. Johnson concluded that the average traffic on state highways is 500 vehicles a day and that highways constructed to accomodate two lanes of traffic will be sufficiently wide to carry the traffic for many years to come.

Miss Beard of the Department of Education of Detroit spoke about the methods used in the public schools of that city in teaching children the elements of traffic regulation and safety rules.

Commissioner Bennett of Connecticut spoke upon the relation of traffic to highway improvement, saying that motor vehicle fees should be increased because improved roads greatly reduce operating costs of motor vehicles. A central bureau of research and information on traffic matters should be established.

American Society of Mechanical Engineers

The American Society of Mechanical Engineers held its spring meeting on May 23 to 26 in Chicago, Ill., and the following papers presented at the Materials Handling Division: "Road Construction Plants," by B. H. Piepmeier, Engineer of Construction, Division of Highways, Illinois; "Mechanical Needs in Highway Construction Machinery," by R. C. Marshall, General Manager, The Associated General Contractors of America: "Planning and Organiza Road Job for Mechanical Handling of Equipment."

National Lime Association

The third annual convention of the National Lime Association will be held on June 15, 16 and 17 in the Hotel Commodore, New York City.

PERSONAL MENTION

Perry T. Naylor has been appointed city engineer of Hastings, Neb.

Fred A. Rhodes has been appointed city engineer of San Diego, Cal.

R. G. Manley has been appointed city engineer and superintendent of streets of Upland, Cal.

John S. Garvin has been appointed secretary of the California State Highway Commission.

Louis D. Blauvelt has been appointed engineer for the Colorado State Highway Department.

I. B. Lanphier has resigned as assistant engineer with the Illinois State Highway Department.

C. Y. Clawson has been appointed district engineer in charge of road work in Weber County, Utah.

F. P. Obee has resigned as deputy county engineer of Lucas County, Ohio, to enter the contracting business.

R. G. Tyler has resigned as city engineer of Paris, Tex., to become dean of the engineering school of the University of Oklahoma.

J. A. Glominski has been appointed highway engineer of the U. S. Bureau of Public Roads, with headquarters at St. Paul, Minn.

L. A. Wilson has resigned as assistant engineer with the Illinois State Highway Department to join the Clinton Engineering Co., Clinton, Ia.

Walter S. Dickey, the largest individual burned clay products manufacturer in this country, has purchased the "Kansas City (Mo.) Journal."

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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Number 23

Training The Personnel of Highway Departments*

Methods of Standardizing the Training of Highway Engineers in Department Service—Courses in Schools—Educational Work in Highway Departments—Engineering Literature—Meetings and Conventions—Roads Inspections— Department Cooperation

BY A. E. FOREMAN†

The extraordinary increase that has taken place in the use of motor vehicles during the past decade is apparent from a comparison of the registration figures for such vehicles and by the traffic records that have been kept on our highways over this period. There is every indication that this use will continue to increase with the improvement of our roads and will carry with it a demand for many more improved roads.

It is estimated that during the next five years between three and four times as much will be spent in the United States for highway construction as was expended for building railroads during the record five years of railroad development. While Canada's highway program is possibly not so well defined over the next 5-year period, still it is assured that hundreds of millions of dollars will be spent on this increasingly important work which has such a vital bearing upon the development and prosperity of our great Dominion. It is, therefore, most important that we should realize the magnitude of the work and the huge sums of money that will be involved and take immediate steps to educate and train highway engineers so that expenditures will be made efficiently under the direction of properly qualified men.

There are at least three methods by which the training of highway engineers may be standardized and high standards of efficiency attained and maintained, all of which are necessary and should be utilized. The three methods to which reference has been made are as follows:

1.—By introducing highway engineering courses into our universities and night schools.

2.—By building up strong provincial highway departments with staffs of the best engineers available and systematically educating them up to standards that will conform to the latest highway engineering practice.

3.—By having close cooperation between the different provincial highway departments so that each may benefit by the experience of the others and, working together, they can attain a high and uniform standard of highway work throughout Canada.

The first requirement, in the opinion of the writer, for reaching these desirable results is the introduction of courses in highway engineering into the curricula of our Canadian universities. Some of the universities in the United States have already done so, and in France there are schools devoted exclusively to this branch of engineering.

Dean Mitchell, of the Faculty of Applied Science and Engineering, Toronto University, in his inaugural address last year called attention to the advisability of expanding this section of civil engineering in the fourth year, and the importance of the subject and the amount of money that will be involved bespeak both our immediate attention and most serious consideration. There should also be short courses in our night schools which inspectors, contractors and others who are working on highway construction could attend and receive instruction on the practical as well as the theoritical side of the work. Secondly, pending the introduction or enlarging of such courses, and to meet the conditions which are facing us today, it is most essential that strong and efficient highway departments be built up in each province, for in the final analysis these will be the backbone of the entire organization for improved highways.

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*Paper presented at 8th annual convention of the Canadian Good Roads Association, Halifax, N. S., May 10-12, 1921.

†District engineer, Portland Cement Association.

The provincial highway department should not only be capable of handling and supervising efficiently, work in which it is directly and financially interested, but it should be in a position to advise the counties and municipalities with reference to the construction and maintenance of their trunk and other roads, and it should also be the unit to cooperate with similar departments in the other provinces, with a view to the improvement and standardization of road work throughout the country. Now the success and efficiency of a provincial highway department depends upon having the proper type of organization, and upon the personnel of its staff. With reference to the former, the writer believes that the best results will be obtained by dividing the province into districts, the size of which will depend upon the mileage of roads and nature and extent of the work to be done. It is preferable at the start to err on the side of having too small rather than too large a staff as it is more satisfactory to increase than it is to reduce the personnel of an organization.

A resident engineer should be placed in responsible charge of each district, and should report to the chief engineer of highways. These district engineers should have as assistants, engineers who have had practical experience in construction work as well as technical training.

Preference should be given to engineers who have worked for contractors and have acquired experience in handling men, and in the practical carrying out of work.

Cases may arise in which it is necessary to do work by day labor and the engineer should be able to organize the work, choose competent foremen and see that it is carried out in a practical, workmanlike and efficient manner.

On government work tact and executive ability are important requisites, as well as engineering training and experience, and to obtain results all appointments to the service should be made strictly on the basis of qualifications. All vacancies in the higher positions should be filled by promotion from the lower grades, such promotions to be based solely on merit. Failure in this respect will seriously affect the spirit and efficiency of an organization. Also, the government should be prepared to pay adequate compensation for services rendered and endeavor to obtain the best men available.

Having a proper organization and a competent staff, high standards of efficiency can be procured and maintained:

(a) By keeping the engineers in touch with the latest engineering practice in road construction by means of literature, etc.

(b) By arousing in the men an interest in and enthusiasm for their work; by creating an esprit de corps among the staff, and by making them feel that they are important units of an active, progressive and up-to-date organization. Morale is an important factor in the success of a department.

With regard to the former, all the engineers should be provided with the best and latest literature on road work.

Arrangements should be made with provincial libraries so that standard technical books may be loaned to any of the district or assistant engineers when required in connection with any special work they are doing. They should also be placed on the mailing list for such publications as those issued by the Bureau of Public Roads of the U. S. Department of Agriculture and similar bulletins; and special articles in technical journals should be called to their attention, or copies supplied to them.

Again, when possible, they should be given the opportunity of seeing actual construction carried on, particularly on classes of work such as laying hard-surfaced pavements, where the methods of construction are continually being improved.

The latter (b) can be accomplished, among other means, by holding annual conferences of the engineering staff. Every member should take an active part in the conference by preparing either a paper or a discussion on some work which he has been doing.

The program should be drawn up well in advance so that every engineer may come fully prepared. The very fact of his having to prepare information to place before other experienced engineers will cause him to use care in securing his data, give him a more thorough grasp of the details, and cause him to take a greater interest in his work.

The results obtained by bringing the men together and giving them the opportunity of exchanging ideas, and the inspiration derived from such a meeting, will be most beneficial and will add greatly to the efficiency of the men and the department.

Thirdly, there should be close cooperation between the highway departments of the different provinces so that they can be of mutual assistance. The chief engineers should be given the opportunity of attending the more important national and international highway conventions where they can meet and exchange ideas and get in touch with the latest practice in highway designs and construction. Information acquired at such conferences is often the result of costly experience on the part of some community and to be able to benefit by their experience without having to bear the expense that was entailed is well worth the time and money spent in sending the engineer to the convention.

Again, the federal highway department, being familiar with the provincial highway organizations and requirements, could assist them in improving their standards with a view to having uniform standards throughout Canada. It could also act as a central bureau for collecting and disseminating valuable information which could be sent out in the form of bulletins from time to time, and would serve to keep the highway departments of the different provinces advised of what others were doing.

Finally, in summing up, to standardize the qualifications of highway engineers throughout Canada and to maintain a high standard of efficiency it is essential:

1.—To graduate from our universities men who have specialized in this branch of civil engineering, and to have courses in our night schools which those who are engaged in highway improvement may attend.

2.—To follow up this preparatory work by systematically keeping them in touch with the latest highway engineering practice, this work to be carried on through well organized provincial highway departments, comprised of competent engineers and bearing in mind that the success of the whole movement will depend very largely upon the efficiency of these departments.

3.—To procure hearty cooperation between the several provincial highway departments, so that each may benefit by the experience of the others, with a view to attaining uniformly high standards of efficiency.

State Highway Department Problems *

By CHARLES J. BENNETT†

The problems confronting administrative officials of state highway departments have undergone a complete transformation during the past ten years. In the early days of highway development, traffic was not a factor and was not given extensive consideration. The administrative officer was generally a man competent to lay out roads so as to improve their general condition for the benefit of local interests and the accommodation of light vehicles. As a result, roads in states where work began early have been improved to an inferior degree and are not suited to the traffic that is developing.

For this reason, the highway administrative engineer of the present should study transportation rather than construction details, for traffic is now the most important factor in the administration of public highway funds.

The highway engineer also should be interested not only in transportation as it affects highways, but in all kinds of transportation, in order to determine how and how much the highway program should be developed. At present no one has a proper conception of the place the highway must fill in the transportation scheme.

Several causes have brought about the development of highway transportation along abnormal lines. There has been a natural tendency toward over-development—generally of the vehicle and at the expense of and to the detriment of the road. Partly because of this over-development of highway transportation and partly because of a lack of funds and materials, there has been a slacking off in the development of railroad facilities.

The use of the railroad for both passengers and freight has been seriously reduced, some of it being due to the proper use of the motor vehicle and some of it to its abnormal or unusual use. In the near future we must ascertain the proper place of each method of transportation in the general scheme. The highway engineer is vitally interested, for if we know the type of traffic to be carried by the highways our problem is simplified somewhat.

Roughly, traffic may be divided into two classes: (1) commercial traffic, and (2) passenger or pleasure traffic. With slight exception, highways suitable for commercial traffic will be adequate for passenger traffic. Because of this, study of the commercial vehicle and its use, and of the highway type suited to it, must be the more careful.

To outline this problem properly, we must know definitely several things about commercial traffic. It is evident that the motor truck has a proper place in the transportation scheme and that, to be economical, it must be operated within a certain limit. At that limit, the cost by truck will begin to exceed the cost by rail. Figures show that at present operating costs this limit is approximately 125 mi.

Variations in conditions will raise or lower the limit. For instance, a material increase in truck license fees will reduce the limit of economical truck operation; a decrease in freight rates will reduce the economical limit of short haul by rail.

Connecticut, lying between Boston and New York City, is almost entirely within the previously mentioned economical truck hauling distance of either city. This is an example of a condition that materially affects railway transportation of local freight.

According to an analysis of truck operating costs, 11 ct. out of a total daily cost of $26.09 is spent for the license fee, which is that portion of the cost that pays for the use of the road. It has been determined experimentally that the unit operating cost on a hard, smooth pavement is approximately 50% of that on an ordinary earth road. The direct operat-

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*Abstract of a paper presented at the Conference on Highway Traffic Regulation, held under the auspices of Yale University, New Haven, Conn., May 23, 1921.

†State Highway Commissioner of Connecticut.

ing cost of the truck to which reference has been made, including gasoline, oil and tires, is about $6 a day. If half of that is saved by road improvement, there is a daily saving of $3 which, reduced to the basis of yearly license fee, figuring 250 working days per year, would allow a maximum fee of $750 as against $27.50 with the 11 ct. a day fee. These figures throw a new light on this phase of the problem.

Connecticut's problem, of course, is not Iowa's or California's. We have no immense distances and we are not developed agriculturally to any extent. The development of our highway system for the two classes of traffic demands a return from the traffic, because but slight local benefit accrues to abutting property owners. This is the traffic problem of Connecticut, so far as the Highway Department is concerned.

We are concerned only incidentally with the safety of traffic; that is the responsibility of the Motor Vehicle Department. Our general concern is the development of the highway system to accommodate commercial and passenger traffic and to do so with the funds secured from the agency using the highways—the motor vehicle. We are not prepared to say just what proportion will ultimately be paid by each type of vehicle, but we hope to establish a definite relation between the commercial vehicle and the passenger car. We must not attempt to secure from the latter an amount exceeding the cost of the service rendered and we should not subsidize the commercial vehicle at the expense of the state and to the detriment of the railroad.

We know that the motor truck has come to stay and we realize that Connecticut is one of the most advantageous fields for its development. We consider it no more than fair to collect from the commercial vehicle a sum sufficient to provide for the extra service rendered to it by the highway. This is the traffic problem of the State Highway Department, so far as it concerns the department itself. Type, width and grade are merely incidentals that can be properly related to the economic vehicle limit when that limit is found.

The future holds a great many problems and before they can be solved they must be expressed in definite form. Information must be secured in order to secure definite factors to include in the needed equations. We have a two-fold problem: We must find the volume of traffic that may ultimately use the highways to be developed and we must construct a type that will accommodate that traffic satisfactorily and suitably. The information at hand is meager. The effects of different types of traffic on different types of road surfaces must be secured; the volume of traffic at different places at different seasons must be ascertained and from it a forecast of the ultimate traffic must be made; studies of impact stresses and innumerable things suggested by the situation must be made.

A count at 56 points in the State of Connecticut, taken for 72 hours early in May, showed a total of 240,900 vehicles, of which 204,300 were passenger cars and 36,500 were trucks. This information is merely preliminary. At particular points the volume is intense; at others light. Collecting these data and drawing inferences from them, we should be able eventually to find the proper solution of the construction problem from the traffic standpoint and determine the types of road to be built at different points.

The relation between the amount of traffic and the cost of highway repair is another factor. It may be shown that eventually certain highways will need certain types of pavements from the forecasts made by the cost of maintenance under certain volumes of traffic and by the volume of traffic which may be determined as eventually using the road. The problem is complicated, but the underlying principle to be emphasized is that, in order to develop our traffic properly, we must secure from it a sufficient license fee to pay for the service rendered. Much has been said about taxing a particular agency for the upkeep of the roads. When it is thoroughly understood, however, that the roads are built for the automobile and without particular regard for any other type of traffic, it seems fair to lay the cost of making these improvements on this agency, which is the most benefited.

What is more needed than any other information is a thorough understanding of the relation between traffic and the highway, and it seem imperative to establish means of securing this information. A bureau of research is needed, and it should investigate the detail relations between traffic and highway. It should not stop there, but should extend its work to a thorough investigation of the transportation problem from all standpoints, including all means of freight and passenger transportation, having in mind the development of waterway, railway, trolley, highway and possibly the air. It is a big job, and of vital importance. Tremendous sums of money are spent in highway improvement and the effect on the public is manifold. Money spent on one agency cannot be spent on the other. Unnecessary work in highway development will mean curtailment of expenditures in other sources, particularly for other means of transportation. The problem should be stated in simple terms and solved in the interests of the general public.

Bore Tunnel on Columbia River Highway

A tunnel is being driven through 100 ft. of rock a few miles east of The Dalles, Ore., which will remove the last obstruction on the Columbia River Highway between Astoria and Pendleton. It is expected that the tunnel will be completed early in July.

Motor Vehicles Statistics

National Automobile Chamber of Commerce Publishes Interesting and Instructive Data on Production and Use of Automobiles and Motor Trucks—Increased Individual Productivity Due to Car Use—Cars and Trucks on Farms—Passenger Cars and Motor Trucks in State and City Service—Motor Truck Express Lines

President Harding has said: "The motor car has become an indispensable instrument in our political, social and industrial life," and the truth of that statement is shown most convincingly in a booklet recently issued by the National Automobile Chamber of Commerce. Its title, "Facts and Figures of the Automobile Industry," indicates its contents, but hardly prepares the reader for the mass of interesting and enlightening data it presents. These data show, for instance, that a very large percentage of motor cars are used more or less for business purposes; that the productivity of the individual is greatly increased by the use of the car; that more than half of the state-owned cars are used by highway departments, and that in 1920 there were nearly 3,000 motorized express lines in the United States. They show many other things about motor cars and trucks and in the following paragraphs some of the data of especial interest to road builders and those engaged in highway transportation are reviewed. All of the data given are taken from the booklet to which reference has been made, and, unless otherwise noted, are for the year 1920.

Production of Motor Vehicles

In 1920 there were produced 2,205,197 motor vehicles, of which 1,883,158 were passenger cars and 322,039 were trucks. The total value of these vehicles was $2,232,927,678, while the corresponding figure for 1919 was $1,885,112,546. Since 1899 the motor vehicle industry has grown from a business with a capital investment of $5,769,000 to one in which there is invested the sum of $2,126,717,377.

Of the motor trucks produced in 1920, more than half were of 1 ton capacity, while nearly a fifth of the total were machines of ¾ ton or less. Only 2% were of 5 tons capacity and only 1% had capacities of more than 5 tons. The percentages of various capacities were as follows:

Capacity	Percentage
¾-ton	19
1-ton	51
1½-ton	11
2-ton	8
2½-ton	4
3½-ton	4
5-ton	2
Over 5-ton	1

The total number of trucks of over 5 tons capacity produced was 3,220.

Increased Productivity Due to the Automobile

The individual's increase in productivity due to the use of the automobile is put at 57%, that conclusion having been drawn from replies to questionnaires sent out by the chamber. These were sent to thousands of automobile license holders whose names were taken at random from the registration lists of ten states—California, Iowa, Massachusetts, Minnesota, Nebraska, New York, Ohio, Texas, Virginia and Wyoming. The data secured are presented in the following table:

Added productivity due to car use	57%
Mileage used for business purposes	60%
Per cent of all car used more or less for busness.	90%
Amount of total mileage used where there is no other adequate communication	34%
Number of owners improving living conditions through use of car (suburban life, etc.)	37%

The percentage gains in productivity through car use in various businesses and professions are given as follows:

Occupation	Percentage
Bankers	33
Manufacturers	33
Contractors	51
Farmers	68
School supervisors	72
Clergymen	98
Salesmen	103
Doctors	104
Real estate and insurance men	113

The Automobile and the Motor Truck Back to the Farm

More automobiles are owned by farmers than by any other one buying class. According to a survey made by the United States Tire Co., only 9% of the automobiles in use are in cities of 500,000 population or over and only 16% are in cities of from 50,000 to 500,000, while 33% are in places of 1,000 or less. The percentage distribution by population is shown in the following table:

Population	% of cars
1,000 or less	33
1,000 to 5,000	22
5,000 to 50,000	20
50,000 to 500,000	16
500,000 or over	9

These figures, it is noted, check with state registration statistics which show the greatest density of car distribution in agricultural areas like Iowa, in which the ratio of cars to population is 1 to 6.

Statistics taken from the "Farm Journal" show that the number of cars per 100 farms varies from a low of 9 in Mississippi to 116 in New Jersey, the ratio being 50 or over in 33 states and 75 or over in 17 states. According to "Automotive Industries," more than 100,000 farmers in Pennsylvania own automobiles, many of them having two or three machines. There are practically 200,000 farms in that state, and upon 14,325 of them motor trucks are used.

Data along this same line, compiled from the "Commercial Car Journal," show the number of farms of 100 acres or more to each truck in use in the various states. This number ranges from 4.9 in Rhode Island to 116.1 in New Mexico, while 13 states range from 18.1 to 21.6 and 16 from 25 to 34.9.

The reduction of farm labor costs by the use of trucks is covered by figures obtained from replies to 1,500 questionnaires sent out by "System on the Farm." Of the truck owners making returns, 20.9% reported the accomplishment of the same amount of work with fewer men; 61.9% reported more work with the same number of men; and 14.3% reported more work with fewer men. In regard to the replacement of horses or mules by trucks, one-third of the truck owners reported that they still used the same number of animals, while the remaining two-thirds reported that a truck took the place of from 1 to 12 horses, the average being 3.4.

The time saved in farm hauling by motor truck instead of by horse has been investigated by Government authorities and the results have been published in Bulletin 910 of the U. S. Department of Agriculture. Data obtained from 753 owner reports secured in that investigation are presented in the following table:

Size of Truck (Tons)	Percentage of Time Saved in Hauling			
	Crops	Milk	Feed	Fertilizer
½	53	52	35	—
¾	60	42	53	57
1	65	57	62	52
1¼ to 1½	67	—	66	63
2	71	—	75	75
Over 2	71	—	—	—

Considerable percentages of different farm products are now transported by motor trucks. According to a survey conducted by the Packard Motor Car Co. these are as follows:

Commodity	Percentage
Milk	24.5
Hay	13.0
Corn	11.0
Wheat	10.0
Oats	7.5
Cattle	3.5
Hogs	3.0
Miscellaneous	28.0

Cars in Public Service

State departments of one kind and another use about 5,000 passenger cars, and highway work accounts for 62% of them. The remaining 38% are divided among other services as follows: Health, 6%; education, 4.5%; agriculture, 4%; prisons, 3%; police, 2.5%; parks, ports and miscellaneous, 18%.

Municipalities employ about 5,000 passenger cars and about the same number of trucks, Los Angeles, Detroit, New York and Philadelphia leading in passenger car use with 370, 315, 295 and 200 vehicles, respectively. The particular uses of these cars (average figures) are as follows: Light and water departments, 22.5%; police, 19%; streets, 18%; fire, 17%; health, 16.5%; parks, 6.5%.

The leading municipal users of motor trucks are New York and Detroit, with 438 and 206 machines, respectively.

Motor Express Lines

In 1919 there were 1,956 motor express lines in the country and in 1920 there were 2,949, an increase or 993 or nearly 51%. The leading states in 1920 were Indiana, with 607; New York, with 586; California, with 307; Pennsylvania, with 153; and Texas, with 126.

Day Labor Costs in Denver

Cost Data Compiled in Laying 112,900 Sq. Yd. of Bituminous Concrete with Day Labor

The City of Denver, Colo., recently laid 112,900 sq. yd. of bituminous concrete on macadam pavement by day labor. The following table shows the itemized cost of this work:

Item	Cost per sq. yd.
Surface mixture	$0.281
Binder mixture	.210
Fuel	.071
Expense	.010
Tools and sundries	.023
Plant repairs	.030
Depreciation of plant	.013
General salaries	.040
General labor	.013
Plant labor	.115
Street labor	.088
Hauling	.086
Total for surfacing	.980
Grading	.150
Total	$1.130

Practically all construction for which the above table shows the average cost was as follows: Asphaltic concrete, 1½ in. thick on a 1½-in. binder course; both Mexican and Calfornia asphalt with a penetration of 50 to 60°; binder course mixed in proportion of 50 lb. of asphaltic cement to 250 lb. of sand and 750 lb. of smelter slag; surface course mixed in the proportion of 80 lb. of asphaltic cement to 85 lb. of limestone dust, 300 lb. of slag, and 535 lb. of sand.

The surface of the streets paved was scarified and material averaging from 3 in. at the gutter to practically nothing on the crown, was removed by wagons. All depressions were filled with good material and rolled.

Various charges entering into the above items are explained as follows: Surface and binder mixture include the cost of asphalt, limestone dust, sand and slag which are used in them; fuel covers all coal

(Concluded on page 306)

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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DETOURS

Entirely just complaints of all but impassible detours will come from motorists all over the country during the next five or six months. They will come not by the scores but by the hundreds and for every one that reaches those responsible for the conditions, there will be hundreds that will never get further than sound will carry them from vehicles negotiating the bumps and mudholes of improvised by-passes.

Much of the impeding of traffic by detours—probably the greater part of it— is avoidable. In the first place, there might be a more general adoption of the plan of building half of a road at a time, meanwhile keeping the other half open to traffic. This usually necessitates a certain amount of traffic regulation, but that is not costly. In most instances, indeed, the cost would be less than that of preparing, maintaining and marking an adequate detour.

When for any reason this plan can not be followed a suitable detour should be provided. This involves four steps—location, preparation, marking and maintenance.

The location consists of selecting the shortest route that is capable of carrying the traffic or that can economically be put into shape to carry it. The preparation includes such reconstruction as is needed to make the route safe and favorable to travel. It is evident that these two processes are so closely related that they must be handled together. The shorter of the two routes may require so much reconstruction that the longer may be better, all things considered. On the other hand it may be possible to reduce the distance very materially by extensive reconstruction or even by building a short stretch of new road, the total cost being less than that of slight improvements spread over a great distance. These are engineering problems that should be attacked with an appreciation of the fact that the object is to facilitate traffic and please the traveler.

The marking of detours is of the greatest importance and it is very generally half done. Many of those who have occasion to use the detours are altogether unfamilar with the country or are acquainted only with the main routes. Detour signs should be placed at every intersection and every fork on the route and should be so designed and placed as to point out the route without allowing the slightest opportunity for mistakes. It would be of advantage to have signs also indicate the length of the route and the condition of the road. These points seem elementary and obvious, but every driver knows the need for observing them and the rarity of observance by those who build the roads.

Maintenance is as essential on detours as on other roads. It is even less often provided.

AN ARIZONA COUNTY'S ROAD BUILDING PROGRAM

While the road program undertaken by Maricopa County, Arizona, is likely to be a record for some time to come, it is merely the forerunner of other big jobs.

Reference to the work under way in Maricopa County has been made in these columns. Briefly, it consists of the construction of over 300 mi. of concrete roads so located as to bring a paved road within one mile of every farm house in that part of the Salt River Valley included within the confines of the county. A contract for 141 mi. of the system has been awarded, and work is under way with an elaborate plant. The cost of the work is to be met from the proceeds of two bond issues, one of $4,000,000 and one of $4,500,000.

The outstanding feature of this contract, in addition to its size, is the very extensive plant being used in its execution. More machinery and less hand labor will characterize road contracts of the future and many valuable lessons should be obtainable from the Maricopa job.

Results of Federal Aid in Vermont*

Besides Enabling the State to Construct 90 Miles of Good Roads It Has Proved of Great Value as an Object Lesson and in Giving a Start on a System of Highways

What has federal aid on highways done for Vermont? I believe it has done far more than enable the state to build 90 mi. of good roads. It has encouraged road building for all the towns and villages, and it has given an example of good construction, good drainage, good foundation, and will encourage good maintenance. It has encouraged the towns in their state aid and town road jobs to get good alignment and good grades so that, as in the case of the federal aid roads, these features of construction will have been done forever, and if there ever comes a time when traffic conditions warrant, and money is available to do the work, surfaces of harder and more enduring types may be added. It has caused the creation of an engineering department which has developed, or is developing, a well trained and efficient force of highway engineers, designers and inspectors. It is also developing Vermont road contractors who are becoming proficient in road construction and are mobilizing efficient highway equipment.

Vermont is not backward in her road construction. Our federal aid project in Moretown was completed and paid for and agreements made on several other projects when the so-called Patrol Committee sent out printed propaganda two years ago to the effect that millions were being spent by the Federal Government on highways and Vermont had not taken advantage of a cent. I do not know just what order that project had in time of completion, but I do know that it was one of the first twelve projects completed in the country, and that Vermont was one of the first four states to complete a federal aid project.

With the federal aid money being spent on our main highways, with a state aid law which insures state money being spent in every town in the state, we can feel that we are building a state highway system, which is better than a few miles of boulevard. A state highway system to accommodate our principal industry—agriculture; also to well accommodate our industries of lumbering, quarrying, mining and manufacturing. When we consider these things, and when we hear from many tourists, from away, the many compliments for our roads and especially our back roads as compared with those in other states, and when we consider, if you please, the needs of our people and their ability to pay, we can feel that in her highway work Vermont stands where she has always stood in her military prowess, where she stands in the quality of her maple and dairy products, her granite, marble and talc, where she stands with respect to the sterling qualities of her boys and her girls—away up at the top of the list of states, which is where she belongs.

Ancient and Modern Road Building in Syria

Engineer of Long Residence in Syria Describes Old Roman Roads of That Country and Highway Work Done Later

Road building and other engineering work in Syria were described interestingly by James A. Patch, of the Aberthaw Construction Co., at the 1921 meeting of the Vermont Society of Engineers. Mr. Patch is a chemical engineer and has spent nearly twenty years in Syria, his chief work having been the teaching of chemistry at the American University at Beirut. Portions of his address dealing with road work are reprinted from the "Proceedings" of the Vermont Society of Engineers in the following paragraphs:

"As to roads, we shall not go further back than the Romans. The engineers of that great empire saw things big, as is evidenced by the great system of highways which connected all parts of the empire with the capital. Syria had its share of these roads, and it is still possible after two thousand years to find some portions in a fairly good state of preservation. Had not the purpose for which these roads were built long since disappeared, and had not builders of later date torn up the paving to use for building their houses, we might still ride over these 'built to last' highways. Portions of the Via Maris which connected the Euphrates with Egypt by the way of Damascus, still untouched because located in uninhabited regions, give us an idea of how thoroughly the Roman engineers did their work.

"In the soft limestone regions some of the roads were paved with hard lava stone brought from the Trachonitis or great lava bed of the Hauran. The blocks which are left are from 2 to 3 ft. square and 8 to 10 in. thick and many are still set in their bed of lime mortar.

"Another great highway, probably built for military purposes, extended up and down the length of the land on the eastern frontier. We are told that troops and supplies were moved back and forth on this road in the eternal task of keeping back the hostile tribes of Arabia, a task which is still imposed upon the rulers of Syria today.

"Between Damascus and Beirut, until very recent times, traces of the old Roman highways were to be seen. In some places the only evidences of the old roads are the milestones. Inscriptions on two of these stones found in the suburbs of Beirut record the number of thousands of paces from Beirut to Antioch.

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*From the report of the Committee on Roads and Pavements of the Vermont Society of Engineers presented at the meeting in March, 1921.

Committee: G. A. Reed, Assistant State Engineer; T. W. Dix, Professor of Highway Engineering, University of Vermont; M. E. Carpenter, District Highway Commissioner, Charlotte.

"The difficulties to be overcome in building these roads, their great extent, and the thoroughness with which they were constructed, leave little for our modern road builders to boast of.

"The engineers of several of the prosperous cities at the beginning of the Christian era built colonnaded ways through their cities. Palmyra, now called Tadmor, Damascus, Gerasa, now Jerash, and other towns of the Decapolis were examples of cities with colonnaded streets. Of these, Palmyra is probably the best preserved example. The 'street which is called Straight' in the Damascus of Paul's time was a colonnaded way of that city.

"Such streets always had at least two rows of columns, one on each side of the pavement. A stone ceiling, resting on the one side on the entablature of these columns and on the other, on the walls of the houses which lined the streets, formed a protection from the sun for the pedestrians as they passed up and down through the city. At Palmyra there is evidence of a second story to the colonnade, a raised sidewalk from which the people could look down upon the street below.

"Almost every column in the colonnades at Palmyra has, about two-thirds of the way up from the ground, a bracket on which was probably placed a bust or statue. Although none of these have been found in place, we are told that fragments of the statues have been dug out of the sand which now covers the pavement of the city street to a depth of 3 or 4 ft. It was a bilingual inscription on one of these columns which was used in working out a key for deciphering the Palmyrene language. * * *

"Under the rule of the Turk there was very little progress along engineering lines. No project of any consequence could be undertaken without an irade from the government at Constantinople. No irade could be secured except by a liberal use of 'backshish,' commonly known in English as a bribe. If by chance a project were put through, there was an imperial commissioner constantly dogging the promoters, who must be well fed in order to keep him and those further up from becoming a hindrance.

"In spite of all these difficulties, a considerable number of projects calling for engineering work were carried out, mostly by foreign capital. Among these are some of the main highways and the city water supplies and electric power stations at Beirut and Damascus.

"The introduction of wheeled vehicles called for the first real engineering. The first modern highway was the 90-mi. diligence road between Damascus and Beirut. The French engineers did their work well, for with years of neglect by Turkish authorities after the road was turned over to them, this way, built over 50 years ago, stood the wear and tear during the war of even the heavy, steel-tired German military trucks, where other roads becme almost impassable. This road, over part of its course, concides with the old Roman road already mentioned.

"In more recent years another French company made a contract with the Turkish Government to build and keep in repair for five years a trunk line road extending the whole length of Syria. Long sections of this road had already been built when the war stopped operations. During the war the company's equipment melted away by theft and appropriation, so that the representatives of the company who returned after hostilities were over, found little left that they could call their own.

"The Ladder of Tyre, a rocky promontory running into the sea, had, until the war, stumped the road builders. It was left to the British Army, spurred on by military necessity, to put over in a few days, with the aid of its thousands of Egyptian laborers, a road sufficiently well built to allow the heavy artillery to pass on to Beirut in that memorable drive through Syria.

"Carriage roads have multiplied rapidly throughout Syria during the past two decades. Sometimes the demands for better transportation facilities came faster than the government could provide for them. A village in Lebanon, some 6,000 ft. above the sea, had its own carriage road which ran the length of the village. A carriage had been brought in pieces on the backs of mules and put together by an ingenious villager.

"It was not long before the village aspired to be connected up with the rest of the world and a local road builder said he could do it. 'Impossible,' said the government engineer, 'the mountain is too steep,' and to the ordinary layman it looked so. 'I'll do it,' said the illiterate road builder, 'and will not ask for a piaster unless I succeed.' He did succeed, but it was years before he got his money. Some said it was because he had done what the educated engineer said could not be done; others maintained that it was because the engineer's palms had not been properly oiled by the builder. However it may have been, it was only after foreign consuls, patriarchs, bishops, and the influential friends of the government officials had been pleaded with that the poor man received his money."

A Bill has Been Introduced in Congress by Senator McCormick to create a department of public works and public lands. Under its terms the Department of the Interior would be reorganized to take over all federal work involving highways, waterways and buildings.

Railroad Official Says Freight Is Small Part of Road Costs

Speaking before the Senate Interstate Commerce Committee in Washington, D. C., on May 31, Edward Chambers, Vice President of the Atchison, Topeka & Santa Fe R.R., said that freight was not an "undue proportion of the total cost of the road." Assuming the average cost of building 1 mi. of concrete road to be $53,000, built according to the requirements of the Minnesota State Highway Department, the freight amounts to only $1,327, Mr. Chambers also stated. This represents 2½% of the total cost.

Country Roads Carry Enormous Crop Tonnage

The country roads of the United States carried a yearly average of 86,500,000 tons of 11 of the principal crops during the period from 1915 to 1919, according to a recent statement from the Department of Agriculture.

It is pointed out that this amounts to 27 tons per 100 acres harvested. Illinois leads in the tonnage provided, its contribution amounting to practically 10% of the total, or 8,855,000 tons. The next two states are Iowa, with 6,590,000 tons, and Kansas with 4,862,000 tons.

"The difference between high and low costs of hauling due to poor or good conditions of roads," the statement concludes, "reaches a large figure in the hauling of this great tonnage, or a large fraction thereof."

Day Labor Costs in Denver

(Concluded from page 302)

used at the plant and on steam rollers on job and fuel oil in the dryer and electric power for derrick; expense includes insurance, taxes, printing, automobile and miscellaneous expenditures; tools and sundries include the purchase of tools and miscellaneous plant supplies, water rental, horse feed and shoeing, lubricating oil and grease.

Plant repairs include repairs and replacements to plant and roller parts; also labor in getting plant in shape before starting up in the spring; depreciation is 20% of the cost of new equipment purchased; general salaries include those of the superintendent, bookkeeper at plant, clerk at administrative office, and an inspector; general labor includes labor in building addition to plant, assembling derrick and any other work not properly chargeable to operation; plant labor includes all labor in operating the plant; street labor includes all labor used on the street in laying the binder and top; hauling includes the cost of trucks and drivers and street rollers and operators; grading includes all labor in preparing subgrade.

Connecticut Bill Would Limit Loads and Widths of Motor Vehicles

A bill which has been favorably reported by the Connecticut Committee on Roads, Bridges and Rivers, would limit the width, length, height and weight of vehicles traveling on highways of that state. Under the provisions of the measure, the maximum allowable width of a vehicle, including load, would be 8 ft. The present limit is 9½ ft. The maximum allowable height is placed at 11½ ft. and the length at 40 ft.

For vehicles equipped with rubber tires 3 in. wide, the allowable weight is 500 lb. per wheel; 3½ in., 750 lb.; 4 in., 1,000 lb.; 4½ in., 1,350 lb.; 5 in., 1,700 lb.; 5½ in., 2,000 lb.; 6 in., 2,200 lb.; 7 in., 3,500 lb.; 8 in., 4,500 lb.; 9 in., 5,500 lb.; 10 in., 6,500 lb.

The state highway commissioner is given authority by the bill to bar trucks of over 4 tons capacity from such trunk line or state aid roads as he believes would be damaged by them.

No Relief for Pennsylvania Contractors

Governor Sproul's Veto of Contractors' Relief Bill Forces Road Contractors to Bear Losses Due to Increased Freight Rates

Governor Sproul of Pennsylvania has vetoed the bill authorizing the State Highway Department to credit $250,000 to railroads as the difference between rates in force when certain road improvement contracts were made and the increased freight rates authorized last year.

The State Highway Department agreed to absorb the increase in freight rates and the railroads extended credits to road contractors. In vetoing the measure, Governor Sproul stated it to be unconstitutional, although the purpose was "commendable because the unexpected and very substantial increase in freight rates had placed the contractors in a position of great hardship."

"Roads that Rains Don't Wash Away"

The following paraphrase of Longfellow's poem hangs on the wall of the New York State Highway Commissioner's office:

Hordes of autos now remind us
 That we should build our roads to stay,
And departing leave behind us
 Kind that rain don't wash away.
When our children pay the mortgage
 Father's made to haul their loads,
They'll not have to ask the question,
 "Here's the bonds but where's the roads?"

The Pennsylvania State Highway Department will open bids on June 21 for $15,000,000 of 5% road bonds. These bonds, with the issues already made, make a total of $38,000,000 of bonds issued of the $50,000,000 authorized in 1918.

Convicts Work on Roads in North Carolina

Forty convicts are now working at the rock quarry at Pinrose, Transylvania County, North Carolina, having been assigned to the Asheville Construction Co. The rock being crushed by them will be used on the Brevard-Blantyre Highway.

Connecticut Tables Proposed Bond Issue

The Legislative Committee on Finance of Connecticut has taken adverse action on the proposal for a $10,000,000 bond issue to finance the construction of hard surfaced highways. The committee felt that it would be unwise to recommend such a bond issue in addition to an issue to help meet the current expenses of the state.

Missouri Legislature Will Consider Road Laws at Special Session

Governor Hyde of Missouri has called a special session of the Legislature to convene June 14. The chief matter to be taken up is road legislation. Last year a referendum authorized a $60,000,000 road bond issue, but because of a defect in the measure, the state has not been able to issue the bonds.

Michigan Sells Road Bonds

The State of Michigan has sold $3,000,000 of 5½% highway bonds to the First National Co., Detroit, Mich., at a premium of $21,540. This is the first issue of state highway bonds under the law passed at the last session of the Legislature, which permits a higher interest rate on road bonds.

One million dollars of 5% state road bonds, issued before the passage of the recent law, which it was impossible to market, were burned in the furnace of the state house in Lansing recently.

Road Builders Want Lower Freight Rates

Road builders and producers of road materials from many parts of the country on June 2 held conferences with railroad officials in Washington, D. C., and urged that freight rates on road materials be reduced to the level in effect before last August. The railroad officials stated they would reply to the requests in a few days.

Shippers of road building materials, representing associations of dealers and producers of sand, gravel, crushed stone and cement, contended that road building, so far as counties and municipalities were concerned, was greatly curtailed because of high freight rates. A return to former rates, they said, would revive construction.

Plans for Detroit-Windsor Bridge Progessing

The proposed suspension bridge between Detroit, Mich., and Windsor, Canada, will be completed in the next few years, according to Charles Evans Fowler, Chief Engineer. The bridge will connect Ontario, the most thickly settled province of Canada, with the Middle West of the United States.

Present plans call for a bridge of the suspension type that will cost $30,000,000. Permission to build the bridge has been given by both the United States and Canada. The main span of the bridge will be 1,770 ft. long, and will accommodate railroad, vehicular and pedestrian traffic.

New Jersey Road Contractors Get Lower Freight Rates

The public Utility Board of New Jersey has ruled that a 40% increase in freight rates as applying to intrastate shipments of road materials is unjust and has ordered the imposition of a tariff 15% greater than that existing before the general increase in freight rates last year. A refund will be made to contractors who have paid the 40% increase since last August, when the increased rates went into effect.

This concession was granted upon the request of road contractors and the New Jersey State Highway Commission and will effect a considerable saving to contractors on shipments within the state.

New Jersey Maintains Detours in Good Condition

The New Jersey State Highway Commission is carrying out the provisions of the law passed this year which provides that good detours be provided when main roads are under construction, according to T. J. Wasser, State Highway Engineer.

"One of the phases of construction on the state road system to which the Highway Commission is giving particular attention this year is the arrangement of proper detours during the time the main sections are under improvement," said Mr. Wasser. "Plans have been so worked out that while the main route is being rebuilt the detour provides a very fair means of travel and is properly marked with signs and arrows for the public's convenience.

"Detours at their best are objectionable, because they are to be of only temporary use; and in former years the practice was to put as little new work on them as possible. The result was generally a narrow stretch of road with practically no surface."

Montgomery County, Kentucky, passed a $250,000 road bond issue on May 28. Only three precincts voted against the issue.

MEETINGS

Calendar of Coming Events

June 20-24—American Society for Testing Materials—Twenty-fourth annual meeting, Asbury Park, N. J. Secretary, C. L. Warwick, Engineer's Club Bldg., Philadelphia, Pa.

June 28-July 1—Society for the Promotion of Engineering Education—Annual convention, New Haven, Conn. Secretary F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Aug. 30-Sept. 1—Michigan State Good Roads Association.—Annual meeting, Flint, Mich. P. T. Colgrove, Pres., Hastings, Mich.

Oct. 24-28—American Society for Municipal Improvements—Annual Convention, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

South Carolina Good Roads Association

A number of citizens of South Carolina met in Columbia, S. C., on May 18 and formed the South Carolina Good Roads Association. Lang D. Jennings, Mayor of Sumter, was elected president; Dr. George B. Cromer of Newberry, first vice president; and W. C. Miller of Chester, second vice president.

The purpose of the association, as stated in its constitution, is to conduct an educational campaign in the state in the interest of good roads and to promote legislation to secure better highways.

PERSONAL MENTION

R. C. Ham has resigned as county engineer of Ford County, Kansas.

C. J. Swift has been appointed highway engineer of Blue Earth County, Minnesota.

R. R. Thompson has resigned as a member of the Arkansas State Highway Commission.

Lund & Hill engineers for Road District No. 1, of Pulaski County, Arkansas, have resigned.

W. A. Falconer has been appointed a member of the Arkansas State Highway Commission.

E. B. Stephenson has been appointed a member of the West Virginia State Road Commission.

G. W. Null has been appointed office engineer in Division No. 3 of the California State Highway Department.

J. C. McElherne, formerly with the Minnesota State Highway Commission, is now county engineer of Rice County, Minnesota.

D. Q. McCombs has been appointed chief highway engineer of the Tennessee State Highway Department, succeeding W. P. Moore, who still remains with the department.

R. W. Parke, formerly a resident engineer of the North Carolina State Highway Commission, in the 2d Division, has been appointed construction engineer of the new 7th Division. His headquarters will be at Elkin.

OBITUARY

Amos Grant Batchelder

A. G. Batchelder, for the past eleven years executive chairman of the American Automobile Association, was killed in an aeroplane accident near Indian Head, Md., on May 28. Funeral services were held at Washington, D. C., on June 1 and the body was taken to Buffalo, N. Y., where it will remain pending interment at Attica, N. Y.

Amos Grant Batchelder was born at Akron, N. Y., Sept. 8, 1868. His first work was as a "printer's devil" with the Attica "News." At the age of 18 he became its editor and later went to the Buffalo "Courier" as a sporting writer. Mr. Batchelder became interested in bicycling at that time and took a very active part in the affairs of the League of American Wheelmen. Later he organized the National Cycling Association.

When automobiles came into use Mr. Batchelder joined the staff of the New York "Mail," later becoming a writer on automobile topics with the Hearst organization. After editing "Motor" for two years, he became secretary of the newly organized American Automobile Association. After a short time in this position he became managing editor of "The Automobile."

After several years with "The Automobile" and other motor publications of the Class Journal Co., Mr. Batchelder returned to the A. A. A. and undertook the job of putting that failing organization back upon his feet. He succeeded and became the executive chairman, retaining that place until his death.

Mr. Batchelder was one of the earliest advocates of good roads and was a frequent speaker at automobile and road associtation meetings. He was always active in furthering roads legislation and took an especially prominent part in the movement that resulted in the passage of the present laws governing federal aid.

GOOD ROADS

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Concrete Roads must be reinforced

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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New Series, Vol. XXI

NEW YORK, N. Y., JUNE 15, 1921

Number 24

Study Proves Two-Track Roads Wide Enough

Prominent Expert Adduces Figures Showing 500 Vehicles to be the Maximum Average Daily Traffic to be Expected on Big Majority of Main Roads—Even Considering Seasonal and Diurnal Variations, Width Greater than Necessary for Two Lines Means Extravagant Design.

"There is no reasonable expectation that our main roads comprising the state highway systems, when completed and carrying their full quota of the traffic, will be called upon to carry on the average more than 500 vehicles per day throughout the year, so that a highway payed for a width sufficient to accommodate two lanes of traffic will suffice for many years to come. It is not to be concluded that there are no sections of highways that will not require more than two traffic lanes, but the mileage of such routes is, and will continue to be, but a small fraction even of the restricted mileage of the state highway systems. Any highway plans contemplating an extended system of highways constructed for a greater width than required by two lanes of traffic are extravagant."

These sentences comprise the conclusion of a paper presented by A. N. Johnson, Dean of the Engineering College of the University of Maryland, at the Conference on Highway Traffic Regulation held at Yale University, New Haven, Conn., on May 23. Dean Johnson based his conclusion on studies of vehicular traffic and road conditions made by the U. S. Bureau of Public Roads and upon observations of traffic on Maryland roads.

The problem of width, according to Dean Johnson, should be studied with regard to three factors that govern the amount and density of traffic upon the highways: (1) The number of vehicles that use the highways; (2) the mileage actually made by these vehicles in a given time, and (3) the mileage of highways that are available for traffic. He points out that the larger the first two are and the smaller the third is, the greater will be the number of vehicles to be accommodated per mile of highway in a given time.

The following facts, according to Dean Johnson, "become very significant" in view of their effect upon the number of vehicles per mile per unit of time that will come upon the highways:

"The total number of motor vehicles, including motorcycles, in the United States, from the latest available information as compiled by the U. S. Bureau of Public Roads, is placed at 9,449,441. While this number includes taxicabs and many other motor vehicles that seldom use highways outside of city limits, no deduction is made from the total as here given in the discussion which follows.

"The average mileage made in a given time, say one year, by each motor vehicle is not known accurately. From data in the possession of the American Automobile Association, it is estimated that an average of 6,000 mi. yearly may be taken as reasonably approximate, while the U. S. Bureau of Public Roads places it nearer 4,500 mi. per year per vehicle. Let us take the higher value of 6,000 mi. and apply it to the total number of motor vehicles. There results a yearly mileage of approximately 57,000,000,000 vehicle-miles. As this total number includes all vehicles, whether confined to city streets or using the highways, it is fair to assume that the highways as a whole today do not develop a total motor traffic in excess of 57,000,000,000 vehicle-miles per year.

"The total mileage of highways in the United States, excluding city streets, is given by the U. S. Bureau of Public Roads as 2,478,552 mi. It is generally the opinion of those who have given the subject close attention that 20% of the total mileage of all the highways carries not less than 90% of all the traffic. As it may be some time before any considerable number of states will have improved 20% of their total highway mileage, and as most state highway systems under construction today seldom exceed 10% of the total highway mileage in the state, it will be more significant to the present discussion to consider the amount of traffic that may be carried upon 10% of our highways. The opinion generally prevails that we may expect 10% of the highways, if judiciously laid out to form a comprehensive state highway system, to carry 75% of all the traffic.

"Upon these data it is practicable to determine the traffic that would develop today on state highway systems, were they completed. Seventy-five per cent. of the total traffic is approximately 43,000,000,000 vehicle-miles per year, which is to be carried upon 250,000 mi. of highways, or a traffic per mile per year of 172,000 vehicles. There thus results an average traffic per mile per day a little under 500 vehicles. It is evident from the rather large values given the factors that control this result that the actual traffic is probably well within the value here found."

This average value, Dean Johnson points out, does not give the number of vehicles that should be provided for, because the volume is different at different seasons and at different times of day.

In discussing seasonal variation, he cites the Baltimore-Washington Road, on which the daily traffic from the middle of June to the middle of October is about 135% of the average daily traffic for the year. In like manner, he cites figures from the report of the U. S. Bureau of Public Roads on California highways to indicate the extent of diurnal variation. These figures show the maximum hourly traffic to be about 30% in excess of the average hourly traffic for the day.

Continuing, he points out that if the average daily traffic for the year be taken as 500 vehicles, the daily traffic during the heavy traffic months is 135% of that, or 675 vehicles. In like manner, if the maximum daily traffic be taken as 675, the hourly average, based on a 12-hour day, would be 56.5. Taking into account the 30% excess due to hourly variation, the desired figure would be 73.45.

While this is the number to be used in designing, there are other factors that must be taken into account. For instance, during the rush-hour period, so-called, a large proportion of the traffic at a given point will often be in one direction. The exact proportion can not be stated from the data at hand, Dean Johnson points out, but he assumes that all is in one direction and that it travels in a single line.

Designating the number of vehicles that pass over a given road as the "vehicle discharge," he derives the formula:

$$N=5280\ V/D$$

in which $N=$ the vehicle discharge, $V=$the velocity in miles per hour, and $D=$the distance in feet from the center of one vehicle to the center of the next.

A diagram plotted with vehicles per hour as ordinates and speed in miles per hour as abscissae, for different values of D will permit comparison of vehicle discharge under varying conditions to be made graphically. If D remains constant, N will vary directly as V. For instance, assuming the average over-all length of vehicles as 15 ft. and the clearance between them as 15 ft., D becomes 30 and with a speed of 15 mi. per hour, N is 2,640.

Now, assuming that the clearance between vehicles varies directly as the velocity, increasing the speed to 30 mi. per hour will increase the clearance to 30 ft. and D will become 45, making the value of $N=3{,}250$ Again, assuming that the clearance between vehicles varies as the square of the velocity, the clearance at 30 mi. per hour becomes four times that at 15 mi. per hour, giving D a value of 60+15, or 75, and N a value of 2,112.

Continuing the discussion of this phase of the problem, Dean Johnson says:

"From some observations made on traffic on the Washington-Baltimore Road during a special rush hour, it was observed that vehicles moving 25 to 30 mi. an hour in groups of 6 or 7 did not space themself nearer together than 50 or 60 ft., or, allowing for the length of the vehicle, the distance between centers was about 75 ft. It was also observed that vehicles moving 10 to 15 mi. per hour frequently were spaced as close as 15 ft., or about 30 ft. center to center. This indicates that the clearance between vehicles may be taken to vary as the square of the velocities, within practical road speeds.

"If the clearance between vehicles does vary as the square of the velocity, we have the interesting fact that a larger number of vehicles will pass a given point at a speed of 15 mi. per hour than at 30 mi. per hour.

"As a matter of fact, the greatest number of vehicles observed on the Baltimore-Washington Road did not exceed 400 per hour, the average speed being about 25 mi. per hour, which would require an average spacing of 330 ft. If 1,000 vehicles were to pass in a single file in one hour at a speed of 25 mi. per hour, the spacing, center to center of vehicles, would be 132 ft. Thus, a highway paved to accommodate two lanes of traffic can readily handle a total traffic in both directions of 1,000 to 1,500 vehicles per hour and, temporarily, during a special rush, may handle over twice these amounts."

The 1920 traffic on the Baltimore-Washington Road, according to Dean Johnson, was somewhat in excess of that of 1918 and 1919. On the other hand, the traffic on the York Road has decreased slightly during the past few years. He notes, in regard to this, that the latter, leading northerly from Baltimore, carries little, if any, through traffic, i. e., traffic between large centers of population such as the termini of the former road. Continuing the discussion, he says, in reference to traffic and road conditions in Maryland:

(Concluded on page 316)

Problems of The Highway Contractor *

Stabilization of Road Building Programs, Standardization of Construction Methods and Cooperation between Contractors and Highway Officials are the Nation's Chief Highway Needs

By **WALTER A. ROGERS†**

With the advance of civilization a new element on which human life is absolutely dependent has developed. All of the necessities, of which food, clothing and shelter are of first importance, must be transported. In primitive times man carried these things on his own shoulders. As time went on beasts of burden were used for transportation on the narrow trail. Then vehicles were built to be drawn by animals, and this necessitated the construction of wider trails or roads.

During the past hundred years, due to the discovery of steam and electricity, has come the development of the steam and electric railroads, operating on a modified form of highway with the wheels traveling on a rail on a solid foundation or roadbed.

The construction of the railroads has made possible the settlement and growth of heretofore inaccessible parts of our country. Before this advent the horse-drawn method of transporting products to and from the markets limited the economical market radius of any particular locality to a very few miles. Wtih the development of the railroads, the economical market radius is very largely increased, in fact limited only by the extent of the country and the competition of other sources of supply.

As the railroad lines increased in length and density of traffic, the rolling stock was made heavier and speed of travel increased, requiring the improvement of the roadbed or the railway highway, from the old iron strap rail on wooden stringers and dirt roadbed to the heavy steel rail and rock ballasted track. Today we have a well defined policy and standard of railroad construction for varying conditions and needs.

Advent of the Automobile

With the invention and development of the automobile a new form of transportation—or rather an advanced improved form of the old vehicular transportation—has come to the front. Just as in the case of railroads, this has necessitated the improvement and extension of the highway systems of the country. The use of this new transportation is limited by the extent of the hard roads development.

There are in this country today approximately 2,500,000 mi. of highways, of which about 50,000 mi. might be developed into national or interstate routes or "main national routes." There are about 400,000 mi. of highways which are state trunk lines and which lead into important centers and to and from important market points. I assume that eventually this 450,000 mi. of highway will be improved in some form. There are now approximately 300,000 mi. improved to a greater or less degree; approximately 45,000 mi. are hard-surfaced, 15,000 of which are concrete, and the balance of the 300,000 mi. are of gravel or similar form of surfacing.

The construction of concrete roads or similar hard-surfaced roads in any territory has meant the lengthening of the economical hauling radius to any particular point from a team haul radius of about 6 to 8 mi. to a truck haul of 15 to 20 mi. or more. The concrete road and truck are doing for the country just what the railroads have done in the development of the United States in years past in developing inaccessible parts of the country.

Concrete has been adopted quite largely by highway engineers as a principal form of material for hard-surfaced roads. The development of concrete in the construction of highways has permitted of their rapid construction and improvement. There is no question but that the construction of concrete and other hard-surfaced roads must go ahead in larger and increasing amounts and we are faced with a stupendous volume of this class of work.

There is danger that the highway program may be made of such magnitude that it will interfere seriously with railroad development, building and other necessary construction work, which is bound to go ahead as soon as the country gets on a normal basis, by absorbing more than its proper share of labor, materials and railroad transportation, partly due to the fact that highway funds may be secured by the sale of tax free bonds, while other construction, which may be just as necessary, can be financed only by taxable bonds.

It is for the best interests of the country, therefore, that we proceed with this work with an intelligent understanding of the problem before us.

I believe that the "United States department of highways" or the "United States department of public works," if our Congress wisely decides to establish such a department, should have a direct supervision of the entire highway program of the country, if possible, to the extent of regulating in a general way the volume of this class of work which should be done in any one year. Our ultimate aim, of course, should be to construct the completed system of main national routes and state trunk lines of concrete or other hard surface and feeders to these trunk lines to be built of less expensive materials.

---

*Address at a dinner of the Executive Board of the Associated General Contractors, Washington, D. C., May 10, 1921.

†President, Bates & Rogers Co., Chicago, Ill.

5,000 Miles Per Year

I feel sure than in the near future we will be building 5,000 mi. or more of concrete roads per annum. In order to get what this means intelligently before us, I am presenting the following figures. For this purpose I have assumed a cost of $40,000 per mile. This would mean for 5,000 mi. of highway approximately $200,000,000 expenditure per annum, the employment of about 100,000 men directly on the construction of this 5,000 mi. for a period of about 8 months, and the indirect employment in the manufacture and preparation of the materials entering into the construction of the highways of approximately an equal number of men, or a total of 200,000 men for a period of about 8 months or an expenditure of $150,000,000 directly for labor per annum.

In addition, an investment in plant of $60,000,000 to $80,000,000 per annum is required to construct a program of this size, which investment would have to be renewed at least every four years.

Whether 1,000 or 10,000 mi. of hard roads are finished per year, it is impossible to complete a program of this kind without the aid of the responsible contractors. Just as the large railroad systems have been built successfully by contract, so must the highway systems of this country be constructed. This means that the public's money for construction of highways must pass through the hands of the contractor to the material and machinery men and to labor. It is probable that over $1,000,000,000 will be spent by the people of this country on hard roads within the next ten years.

Development Follows

It seems to be a fact that in the history of this country some form of construction has been the factor that has made possible the subsequent development of the country. For example, the construction of canals permitted the development of Ohio, construction of the railroads in the 20 years after the Civil War permitted the development, agriculturally, of the western country.

Often this development has seemed to be in advance of its need, but subsequent history has proved that the money has been well spent and that the rapid development of the country has only been made possible by this construction. It seems to me that we are facing an era of highway development comparable to the railroad development in the 70's and 80's. With the history of the past before us, and in view of the magnitude of work to be done, it is well to consider how the interests of the public may be best conserved in this work.

It is evident that this public interest can only be served by the construction of the best, most permanent roads at the lowest cost consistent with quality, and which will stand up under the loads put upon them, and then limiting the load which can be hauled on them to that for which they were intended.

The construction of concrete highways is a highly technical matter requiring skill obtained only by experience and a competent organization, with a very expensive plant compared to the volume of the work. This can be secured only by the employment of a competent contractor. In order that this end may be attained, it is absolutely necessary that reliable, responsible contractors of experience be attracted to this class of work.

Work Not Desired

In the past, highway work, because of the conditions surrounding it, has not been considered desirable by responsible contractors generally. In fact it has proved to be one of the most hazardous forms of contracting, because of conditions surrounding this work over which the contractor has no control. One of these conditions is that of transportation of materials. This work is absolutely dependent for its economical handling on a uniform supply of materials over the railroads, and in the past this has been difficult if not impossible to obtain. Another condition is that which obtains in the construction of any class of work under any branch of the Government. However, we hope for improvement in transportation conditions and lessening of this uncertainty.

In addition, if the better class of our contractors are to be induced to do this class of work, there are certain cardinal principles which must be adopted in connection with this work. Three of these principles I designate as Standardization, Stabilization, and Cooperation. Let me explain.

We have in this country 48 states and each state has its different type of highway, different specifications as to materials and workmanship, different methods of payment and different types of organization for handling the owner's side of the work.

The contractor who gains his experience and adapts his plant for work in one state, has to remodel and recast his ideas for work in another state. Cost data gained in one state or even sometimes in one county of the state are not applicable without adjustment for another county or in another state.

Materials acceptable in one state may not be in another. The proportions of concrete materials are different. Take the one item of time of mixing the concrete. One state may require that the concrete be mixed 1 minute, another state 1½ minutes to

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City Traffic Regulation *

First and Most Important Principle of Regulation is Education of Those to be Regulated—Difference Between General and Special Regulations—Essential Characteristics of General Rules—Methods of Regulation—Importance in Saving Lives and Money.

By WILLIAM P. ENO†

The science of highway traffic regulation consists in the knowledge of how to regulate the movement of vehicles and pedestrians so that they interfere with one another as little as possible and are enabled to go from point to point in the shortest time compatible with safety. Traffic regulations are divided into two parts—general and special. General highway traffic regulations are those which contain all things essential for the largest city and nothing superfluous for the smallest village. Such regulations should be standardized and their general use insisted upon throughout the whole country. Failure to realize this fact has always resulted in chaos and unnecessary loss of life.

In the scientific regulation of traffic, the first and most impartant step is the education of those to be regulated. If this principle is followed the work of the police becomes that of promoters and assistants rather than that of enforcers. Drivers and pedestrians, when they know their rights, become the real regulators, as they resent infraction by those few—a constantly diminishing number—attempting to over-ride the rights of others. This was once a theory, but to those familiar with the work it has long since proved to be a fact. If educational measures are relaxed, traffic regulation goes backward.

It is essential that general traffic regulations be brief or they will not be read, clear or they will not be understood, reasonable or they can not be enforced, uniform or they will result in confusion and danger. The first set of general highway traffic regulations was adopted in New York on Oct. 30, 1903. These have gone through many revisions. They were officially issued in Paris on July 10, 1912. On May 8, 1919, a new revision, most carefully prepared, was offered for standardization by the Council of National Defense through its highways transport committee. It is not probable that any other set will be compiled in the near future which will be better, although arrangements should be made so that, from time to time, suggestions for improvements can be considered.

The greatest trouble in traffic now is that many of the cities have delegated aldermen, commissioners or police officers to formulate traffic rules. These officials, with few exceptions, not content to profit by the experience of others, appear to have been actuated in their legislative efforts by a desire to originate and satisfy a pride of authorship. The result of their efforts has been that, while they have plagiarized themselves by adopting everything of value in the New York regulations, these have been so distorted by rearrangement, rewording, and by important omissions and unimportant additions, that the patchwork thus produced has been confusing and much too long. The sets of regulations given to some of our cities contained over 6,500 words, lacking both sequence and order and mixing up special regulations with general regulations.

Traffic regulations should never be in the form of an ordinance, but there should be an ordinance or some other law empowering the police departments to adopt the Council of National Defense code without change of any kind. This is the practical way of attaining uniformity so much to be desired because absolutely necessary for safety.

The Council of National Defense code is printed in a 4x6-in., four-page folder in an especially approved form, containing marginal notes, and on a placard about 14x20-in. The folders should be kept for distribution at every police station and every driver should be obliged to pass an examination on the regulations and carry a copy with him when driving. The placards should be displayed in public garages, stables, schools and station houses, and on standards in public places in order that pedestrians as well as drivers may have an opportunity to become familiar with them. Schools should instruct their pupils in the regulations and hold examinations and drills. We must rely on education of pedestrians through directions which appeal to common sense.

In trying to educate the public in general regulations we should eliminate all thought of special regulations, which must not under any circumstances be written into or form a part of the general regulations. In addition to the folders and placards of regulations, cities should issue a pamphlet setting forth the special regulations, particularly those in regard to the approach to and departure from places of assembly, a list of one-way traffic streets, the method of obtaining licenses for driving, the

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*Paper presented at the Conference on Highway Traffic Regulation, held under the auspices of Yale University, New Haven, Conn., May 23, 1921.

†Washington, D. C.

Highway Work in the Province of New Brunswick[*]

Rapid Growth of Motor Traffic Necessitated Modification of Construction Methods—Only Small Percentage of Highways Required Hard-Surfacing—Natural Gravel Used for Remainder—Higher Taxes Needed for Maintenance—Contract and Day Labor Work Compared.

By B. M. HILL[†]

Since 95% of the road work in New Brunswick consists of building roads of the improved gravel type, any discussion of types and methods in that province must deal particularly with roads of that kind.

Until 1917, the province had no organized system for road improvement. In at least 75% of the area the soil is a splendid material for natural earth roads and so long as it was necessary to contend with only team traffic no serious difficulty was encountered. When the automobile came there was real difficulty.

Previous to 1917, the only road improvement work was done by supervisors who were given grants of money from the ordinary revenues of the province. As automobiles grew in number, the government attempted to solve the problem by increasing these grants, but this method was soon found to be entirely inadequate.

A permanent road organization was established in 1917, with the writer as chief engineer. It was found that there were 15,000 mi. of roads in the province, including three classes: (1) main trunk roads connecting with other provinces or with the States; (2) secondary roads, that were carrying a large percentage of the traffic because they ran through the more important farming districts, and (3) a large mileage of branch roads serving as feeders to the secondary roads. There were 11,500 mi. of by-roads on which it was difficult to spend a large amount of money for some time.

During the first year $250,000 was spent on the worst spots in the road system, but an inspection trip made in June, 1917, revealed some absolutely impassable places. The only proper method of starting the improvement of these roads was the improving of the worst links so that they would be passable for automobiles between June and November. This necessitated jumps from one isolated section to another. Some sections so improved were only a half or a quarter mile in length, but they were so selected as to link up considerable stretches of good natural roads and in two years' time enough had been accomplished so that practically all trunk roads were passable by June 1.

A traffic census taken in 1918 showed some sections carrying from 500 to 2,000 cars daily. These were few in number and were near large centers where there was a considerable amount of local as well as through traffic. On other sections the traffic did not amount to more than 150 cars a day and on some of the main trunk roads it was not more than 50 cars a day.

It was decided to build roads of a heavy type on the roads carrying heavy traffic and to merely provide for dragging the roads of lighter traffic.

When in 1919 the provincial department was asked to prepare a program of federal aid work, it designated the main trunk system, with the exception of a few miles, the total specified amounting to 1,250 mi. Secondary roads are improved with money from provincial bond issues, and by-roads are maintained from the ordinary revenues by building up such portions in low lands as are impassable for automobiles. This is about all that can be done with these by-roads for a number of years, but even these small expenditures will make them as good for the traffic they have to carry as are the others.

It was found that out of the total mileage of main roads, only about 50 mi. carried enough traffic to warrant hard-surfacing or paving. In time it may be necessary to consider hard-surfacing other sections, but in the meantime there are other methods that may be employed. When the natural road is inadequate, it may be graveled and the gravel surface treated. When the traffic becomes too great for that surfacing, a pavement can be put down and there will be no loss because of having built the gravel surface since it is considered not only good engineering but also economical road construction to build permanent grades four or five years ahead of paving, in order to allow the roadbeds time to settle. In fact, it is a question if all roads should not be gravel surfaced before paving.

Since over 75% of the area of New Brunswick the natural soil is a good road building material, it was decided to build a type of gravel road suited to local conditions and to the traffic. The type being built is 30 ft. wide between ditches and 22 ft. wide from shoulder to shoulder, with an 18-ft. gravel surface from 6 to 8 in. deep. In sections of less traffic the road is narrowed to a total width of 26 ft. between ditches and the graveled portion is reduced to a width

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[*] Abstract of a paper presented at the 8th annual convention of the Canadian Good Roads Association, Halifax, N. S., May 10-12, 1921.

[†] Provincial Highway Engineer of New Brunswick.

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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ROAD CONDITIONS NOW AND TEN YEARS AGO

Any body inclined to belittle the progress made in road improvement during the past ten years would do well to consider the results of a recent test run between New York City and Boston made by two motor trucks.

Ten years ago a leading truck maker began the manufacture of worm-drive machines. One of the first models was driven from New York to Boston as a demonstration and has since seen service to the extent of some 175,000 mi. Late last month the same machine—incidentally, driven by the same driver— was sent over the route again. It made the trip in 2 hours and 20 minutes better time than it did ten years ago. One of the latest models of the same make of truck also made the trip, its time being about three hours less than that of the old machine.

While the object of the trip was to demonstrate the advances made in motor truck manufacture, there is another point to be noted.

Ten years ago the best machine the truck maker could put out made the 240-mi. trip in about 20 hours. Now the company's best efforts produce a truck that makes the same route in a trifle less than 15 hours, practically 25% better time. This shows gratifying progress in truck design.

Does it not indicate also a marked betterment in road conditions?

WHAT THE CONTRACTORS WANT

Success in carrying out road building programs depends in a large measure upon the contractors. If more of the responsible, able firms now doing business in the general field can be interested in highway work, the first step towards putting the work on a better basis will have been taken.

One of the reasons why larger numbers of the right kind of contractors have not been attracted to the road building field is the absence of definite programs of highway work. Attention is called to this in an address printed elsewhere in this issue. It was delivered by Walter A. Rogers, who is the head of a contracting firm that has had large experience in road work and who knows whereof he speaks. Besides, this need, which Mr. Rogers defines as "stabilization," other pressing needs in the work are standardization and cooperation.

The address is a fair and able presentation of the contractor's side of the question—which, in the last analysis, is also the engineer's side—and is well worth careful consideration, not only by other contractors but quite as much by engineers in charge of highway work.

EDUCATION TO CUT DOWN THE NUMBER OF HIGHWAY FATALITIES

Between fifty-five and sixty thousand people lose their lives on the highways of this country every year, according to estimates cited by Wm. P. Eno, the well known traffic expert, in a paper printed on other pages of this issue.

Translated into terms of money—the only language understood by too many in this day and generation—that means a loss of more than a half billion dollars annually, if we estimate a life at ten thousand dollars, the amount frequently allowed as damages by the courts.

These figures should make us stop and think.

This great loss of life, Mr. Eno believes, "is largely due to the fact that practically every city has been allowed to make its own regulations, which are usually enforced by untrained traffic officers."

There can be no doubt that better traffic regulation would very materially reduce the number of accidents, fatal and otherwise, but many of the accidents are in localities where there is no attempt at direct traffic regulation and where such control is not feasible. These accidents, like the majority of those in places where traffic is subject to police regulation, are nearly all avoidable, for they are chiefly due to carelessness on the part of road users—both pedestrians and drivers of motor vehicles. And in bringing about their avoidance the first and most important step is education, just as, according to Mr. Eno, it is the first and most important step in the scientific regulation of traffic.

Motor vehicle operators need a lot of education, especially that kind of education that will teach them that their rights end where the other fellow's begin. Pedestrians and drivers of horse-drawn vehicles need still more. It is possible to enforce upon drivers a certain minimum knowledge of car operation and at least a decent regard for the rights of others by means of more stringent laws governing the qualifications for driving. The education of the pedestrian—who is generally at fault in case of accident—is a more difficult matter. Ways and means of effecting it furnish profitable subjects for study.

Study Proves Two-Track Roads Wide Enough

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"The following data are presented for comparison with similar data presented in the first part of this paper. There were in Maryland in 1920 approximately 125,693 motor vehicles and a state highway system of 1,726 mi., practically completed, so that traffic may be said to have found the roads and the roads have received their traffic. On the bases before assumed, that each motor vehicle travels 6,000 mi. a year and that 75% of all such travel comes upon our state highway system (that of Maryland being very close to 10% of all the highways) we have a total travel of 565,618,500 vehicle-miles, or a daily average of 900 vehicles per mile. This agrees closely with the traffic noted on the Baltimore-Washington Road, which was seen to be about 1,000 vehicles per day on the average throughout its length. The York Road averages much less. Time has not permitted careful analysis of the traffic records of all the roads of the state highway system of Maryland, but it is to be noted that there are some roads averaging well over 1,000 vehicles per day, while the larger portion of the state highway system receives much less traffic. Thus, it is probable that the traffic as here computed to come upon our state highway systems is reasonably close.

"The traffic upon the roads of the Maryland highway system is not increasing at an extraordinarily rapid rate; in fact, in some instances it actually decreased for 1920. The explanation is not difficult to find. The number of motor vehicles is reaching a practical limit of man-power to drive them; the number of owners possessing more than one motor vehicle is increasing, thus decreasing the average yearly mileage made by each motor vehicle; the use of roads other than state highways is increasing. All of these conditions combine to produce a retarding effect on the increase of traffic upon the main roads of the state."

Problems of the Highway Contractor

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get the same results, when probably mixing ½ or ¾ minute with a satisfactory machine would give equally good concrete.

Standardization Needed

What is the result? It costs 50% more in labor and fuel to mix concrete 1½ minutes than it does a minute, or twice as much as it does to mix ¾ minute. The highway engineers of the Federal Government and the different states in cooperation with contractors of experience in this class of work should standardize plans and specifications and other features of the work, if the money of the people is to be spent economically.

By stabilization I mean that a definite program covering a period of years should be adopted. The investment in plant and organization for highway work is greater than that of almost any other contract work, in proportion to the volume of work. It is hardly reasonable to expect that a large outlay for plant to handle this work will be made without reasonable assurance that it will be employed long enough in reasonably profitable work to justify the investment.

Definite programs of work should be adopted by the state or Federal Government covering a fairly definite amount of work to be done each year in the various districts for a period of years.

I can best explain what I mean by reciting the history of the highway programs for the last three years. In 1919 a considerable effort was made by various highway departments to get the responsible contractors of the country to take on highway work. Certain programs of work were outlined, which indicated that this class of work would be available for a number of years, with the result that a good many of the most responsible contractors were attracted to this class of work.

Heavy Investment Made

They invested heavily in outfit, took work at what seemed a reasonable price, but more work was let in 1919 than there was material available to build, more than there was transportation to carry the materials from the sources of supply to the work. The result was that the 1919 program was not finished until 1920, and some not even then.

As a consequence the volume of work let in 1920 was very small, but 1921 started with a comparatively clean slate. Contractors were led to believe that a normal program would be adopted for 1921 and the work would go ahead. This has not been the case, but the work has been materially curtailed and the large investments in plant and organization are idle.

What the contractors of the country want is that a certain definite policy be adopted as to the program of work to be done over a period of years, and that the work be awarded either in the fall or early in the winter, in order that the contractors may make provisions for materials, plant, etc., ready to start immediately when weather becomes suitable for doing contract work. This is what I mean by stabilization.

The contractors of the country and the Associated General Contractors of America are prepared to cooperate with the public, represented by its highway officials, in building roads as economically as they can be built. The contractor knows what the work costs. He knows what unnecessary frills cost. He is the only one in a position really to know.

Getting Together Urged

We stand ready to impart this information to the proper people, and the highway problem will never be satisfactorily settled until the highway officials and contractors acquire the spirit of cooperation, where they will sit down together and arrange the specifications and contracts in such a way that all non-essentials are out, and unnecessary, expensive and drastic features are modified. I am happy to say this is being done in some of the states.

Further, we are prepared, whenever there is any thought on the part of the representatives of the public that we are profiteering, to cooperate with the proper people to determine the truth or falsity of the charge in every way by giving cost data analyzed into its different elements, taken from the records of reputable contractors.

I want to repeat that our organization stands ready to assist in getting roads built at a reasonable price. As a matter of fact, almost without exception, the country has paid considerably less than cost for its concrete highways the last few years.

This cannot continue and there must be a willingness to pay a price for this work, which will result in a reasonable profit, or else the responsible concerns will withdraw from the field and in the end the cost to the public will be increased by the employment of irresponsible firms.

If standardization, stablization and cooperation are adopted as the slogan of the concrete highway program, we will then build this concrete girdle around this great country of ours in such a way as to get the greatest return with the least expenditure of money, which is the desire of the A. G. C. as a body and of its individual members.

Ohio Will Wait for Lower Freight Rates

No more contracts for road construction will be let by the State of Ohio until the proposed lower freight rates on road materials go into effect, according to a recent announcement by Leon G. Herrick, State Highway Commissioner. The letting to be held on June 24 has been indefinitely postponed.

City Traffic Regulation

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registration for vehicles, laws on equipment, etc., etc. This, however, is a separate and distinct thing and must not be confounded with general regulations.

Special regulations are those which can be brought about by traffic guides consisting of lines, signs, standards, bumpers, dummy cops, semaphores, crowsnests, direction lights, etc., which can be extensively employed to guide the movements of both pedestrians and drivers.

Lines are of exceeding importance but not when unscientifically placed. Trained experts should be employed to lay them out.

Signs should denote their meaning, so far as practical, by their shape and color, different color combinations being used for different purposes. The best combination consists of vivid yellow letters, arrows or graphics on a black background. These should be used for moving vehicles. Secondary signs for stationary vehicles should have these colors reversed and tertiary signs, or those for the control of pedestrians, should have red letters, arrows or graphics on a white background.

Standards should never be joined by ropes, chains or pipes, as such practice is dangerous. They should be only sufficiently heavy to remain in place in a high wind. Their bases should be of a special pattern to avoid rolling if knocked over. It is better to accentuate their visibility by placing them within painted lines or on a white disk. The bases and tops of portable standards should be painted bright red and the pipes with black and white bands from 8 to 12 in. wide, the top and bottom bands being white.

Bumpers should be kept painted white and should stand on painted white disks so that they can be more easily seen.

"Dummy cops," or posts designed as substitutes for traffic officers, first recommended in 1904, have multiplied so that there are now hundreds of thousands of various designs. They should be standardized so far as possible, painted in the same way as traffic standards, placed on white disks and effectively lighted at night. The dummy cop is far more effective and certainly more economical than anything else except an expert traffic officer and when such an officer is not available a dummy cop should be used.

Semaphores should be so constructed that their signs may be placed in a neutral position and then they may be left as dummy cops when there is no traffic officer on duty.

Crowsnests, such as used in Detroit, have proved of inestimable value and should be investigated carefully for use in every city.

Traffic regulation lights should be given further study in order to develop them for traffic purposes.

The general and special duties of police in traffic regulation, uniform code of signals, traffic bureau, traffic court, etc., are treated at length in the text book entitled "The Science of Highway Traffic Regulation" (by W. P. Eno). There are, however, certain points that should be insisted upon if we expect to reduce the loss of life and increase the saving of time.

The head of a police department should never attempt traffic regulation himself, but should delegate his powers to an officer not responsible to any one except the head of the department. He should have full authority and be held accountable for results only. Members of the traffic squad and other policemen when detailed on traffic duty should be under his control. He should have ready for use at all times a motor car in order that he may keep in close touch with his work.

The only way the world can make up for the cost of the war is by administering public as well as private enterprises in the future so that they may function without avoidable waste of life or money. In computing what traffic regulation can do, we are forced to adopt premises more or less conjectural, though founded on experience. The figures are given for what they are worth.

It is not possible to obtain an accurate count of lives lost by traffic accidents because many of the injured get away and die afterward, leaving no record. Estimates of the yearly loss of life in the United States (from traffic accidents) run from 10,000 to 57,473, the latter estimate being from an official report from Australia for the year 1920. This report states that during the nineteen months when the United States was in the war 48,000 men were killed in battle or died of wounds and that during the same nineteen months 91,000 were killed on the highways, 25,000 of these being children of school age. This is at the rate of 57,473 in a year, and at $10,000 per life—the amount the courts usually allow—it means a loss of $574,730,000. This sum, added to the financial loss through accidents to persons and property, the saving of time and money to people and the increased efficiency of vehicles through traffic regulation, indicates a loss of more than $3,000,000,000.

We may fairly suppose that if there were no traffic regulations twice that amount would be lost, and we may also assume that if traffic regulation was twice as good as it is we would save at least half of what is now lost, or $1,500,000,000 per year.

These figures, inaccurate though they may be, since they are founded on assumed premises, I believe not to be exaggerated. It is now time for us to realize that the subject of traffic regulation must be taught in schools and in universities and the problems worked out by engineers of ability.

Nearly ten years ago, many of our city planners and other engineers began to take an interest in traffic regulation until now the subject may be regarded as a legitimate branch of civil engineering and as such it should be in the hands of men thoroughly trained for the purpose.

The great loss of life, time and money is largely due to the fact that practically every city has been allowed to make its own regulations, which are usually enforced by untrained traffic officers. Such methods are uneconomical and should be superseded by those of intelligence.

Would Restrain Illinois from Giving Counties Road Refunds

Representative Harry M. McCaskrin of Rock Island, Ill., has petitioned the Sangamon Circuit Court for an order restraining the state treasurer and auditor from paying $3,740,935 to 47 counties of the state as a refund for building state roads. The bill providing for this refund has passed both houses of the Legislature.

Colorado Roads Damaged by Floods

At least $20,000,000 will be required to repair highways and bridges in Colorado damaged by the recent floods, according to L. D. Blauvelt, State Highway Engineer.

"From all reports received," said Mr. Blauvelt, "I am convinced that Governor Shoup's request for $20,000,000 from the Federal Government to be used in restoring the road lines of communication is very conservative."

Indiana Will Aid "Ideal" Section

The Indiana State Highway Department has agreed to provide $33,000 per mile toward the construction of the "ideal" section of the Lincoln Highway in Lake County, Indiana, according to a recent report. The state agrees to undertake the maintenance of the section and the association expects to make arrangements with commercial organizations of Lake County for the maintenance of trees, the supplying of lighting current, etc.

Goethals May Build Cuban Roads

Gen. George W. Goethals has recently returned to New York City from Cuba, where he conferred with officials relative to proposed road building in that country. It is reported that Gen. Goethals has expressed willingness to take general charge of the work.

It is planned to build a highway that will connect Havana with the extreme eastern and western parts of the island, extending west to Pinar del Rio, Guane and Arroyos de Mantua and east to Matanzas, Santa Clara, Camaguey, Holguin, Manzanillo, Santiago de Cuba and Guantanamo.

New York to Eliminate Many Grade Crossings

The elimination of grade crossings in New York State will form an important part of the work of the State Highway Commission, according to Herbert S. Sisson, Commissioner of Highways. In planning for road improvements grade crossings are being eliminated whenever possible. There are 8,329 grade crossings in the state, of which only 2,553 have adequate safeguards to traffic.

Townsend Bill Reported by Committee

Measure Reported Favorably Notwithstanding Its Many Inherent Defects are Pointed Out by Road Officials

Hearings on the Townsend Bill were concluded one June 13 by the Senate Committee on Post Offices and Post Roads and the measure has been favorably reported by the committee. It is expected that the bill, with some modifications will be passed by the Senate promptly. The Dowell Bill, introduced in the House, will probably be passed by that body. Since the Townsend Bill recognizes many of the features of the existing system of federal aid, it is thought the aims of the two factions can be harmonized and further federal aid funds appropriated during the present session. The hearings on the Townsend Bill brought out many important points which will guide the final drafting of federal aid legislation.

Among the witnesses at the hearings on the Townsend Bill was John Mackall, who said in part:

"The intent of this bill is very clear that the Federal Government, without regard to the state, shall select a federal system of roads.

"The width of 66 ft. for right of way (as provided by the bill) would be unfortunate. There are many places where to acquire a right of way, 66 ft. wide, would cost more than to construct surfacing that width."

Thomas H. MacDonald was called again before the committee and among his remarks, said: "If authority is assumed by the Federal Government to arbitrate disputes as to which of two roads shall be followed, assuming that both roads meet the conditions set up in the law, I believe the Federal Government would have an endless number of disputes to settle, particularly disputes which have been disposed of once."

Philip Perlman, Secretary of State of Maryland appeared and objected to placing in the hands of a federal commission the power of selecting the roads to form the interstate highway system. "What you are doing, and it may be intentional," he said, "is having a bill that gives state aid to a federal project instead of federal aid to a state project."

Highway Work in the Province of New Brunswick

(Continued from page 314)

of 16 ft. In districts where roads run through woods, with intervals of 15 to 20 mi. between houses, they are made 22 ft. wide between ditches with graveled surfaces 14 ft. wide. This variation in width materially reduces the cost of construction, meets the needs of traffic for the next five or six years, and saves enough in interest on the cost of construction to pay for widening later.

This variation in width also reduces the cost of maintenance; and maintenance is a big question because the money for it has to come from the ordinary revenues. In sections where the traffic amounts to only 50 or 60 cars a day the traffic is not sufficient to roll out the surface of the road. In such case the graveled surface would be much wider than that portion of the road used by traffic and there would be heavy growths of grass on the shoulders, so adding materially to the cost of maintenance.

Speaking generally, it is believed that the public should be educated to the necessity of really heavy taxation for the maintenance of roads. In New Brunswick the annual cost of maintenance is about $250,000, and, in the writer's judgment, $750,000 is required. The money can come only from taxation and it is believed that the people will not object if they realize what they are getting.

In federal aid work there has been some difficulty in reaching decisions as to the class of road to be built and the method of construction. The federal authorities wanted all the work done by contract and there was a lively discussion as to whether or not it could be done more cheaply by day labor than by contract. Last year, when labor was very scarce, the government built more cheaply than the contractor, because it could get just as much labor for a dollar as the contractor could. When labor becomes more plentiful the government can not compete so well with the contractor. A contractor undoubtedly can build roads as cheaply as a government department—perhaps for 10% less when he has an efficient organization. But his price will be a great deal higher than the government's cost, because he will add a profit. After the cost of a job has been estimated, 20% is added as profit if the job is a small one and 15% if it is a large one. On the best work the bids are very close to the estimates, but on other jobs the contractors seem to bid without caring whether or not the work is awarded to them. In a recent letting bids on four jobs in a good locality were very close, while bids on two jobs in isolated sections were 40 to 50% higher than the estimates.

Much help has been received from other provinces and from the States. In the State of Maine conditions are identical with those in New Brunswick and

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MEETINGS

Calendar of Coming Events

June 20-24—American Society for Testing Materials—Twenty-fourth annual meeting, Asbury Park, N. J. Secretary, C. L. Warwick, Engineer's Club Bldg., Philadelphia, Pa.

June 28-July 1—Society for the Promotion of Engineering Education—Annual convention, New Haven, Conn. Secretary F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Aug. 30-Sept. 1—Michigan State Good Roads Association.—Annual meeting, Flint, Mich. P. T. Colgrove, Pres., Hastings, Mich.

Oct. 24-28—American Society for Municipal Improvements—Annual Convention, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

PERSONAL MENTION

B. C. Wells, formerly City Manager of El Dorado, Kan., has been appointed city manager of Atchison, Kan.

J. W. Mylchreest, of the contracting firm of Mylchreest Bros., Middletown, Conn., has been appointed city engineer of that city.

William E. Hawkins has resigned as county engineer of Sussex County, Delaware, to go with the North Carolina State Highway Department.

Patrick Philip, Vancouver, B. C., has been appointed chief provincial engineer of District 4 of the Department of Public Works of Canada.

W. A. Bechthold, formerly Assistant County Highway Commissioner of Racine County, Wisconsin, has been promoted to the office of highway commissioner.

William Couper, formerly Assistant General Manager of the Associated General Contractors of America, entered the employ of the Texas Co. on June 1.

C. S. Currier, formerly a location engineer in the North Carolina State Highway Department, has been transferred to the 7th District and made district engineer.

J. T. Anderson, formerly with the Pennsylvania State Highway Department, has been made general superintendent with N. M. Leigh, a contractor of Mannington, W. Va.

Leslie H. Allen has been appointed assistant manager of the Cement Products Bureau of the Portland Cement Association. Mr. Allen was formerly with Fred T. Ley & Co., contractors, of Springfield, Mass., as sales manager for the New England territory.

Highway Work in the Province of New Brunswick

(Concluded from page 319)

the assistance rendered by the Maine officials has saved the province costly experimental work.

In 75% of the province gravel can be obtained with a very short haul. Some of it has a clay binder and some of it a sand binder. The clay gravel packs quickly under traffic, but soon shows surface wear. Where this is available it is used in the base, being laid in a course 5 or 6 in. deep and covered with a wearing course of screened sand gravel 2 or 3 in. deep. An attempt is being made to maintain these roads with screened gravel from ¼ to 1 in. in diameter, which gives a surface that is constantly alive and that prevents the disintegration of the base. Many complaints are received that this requires a long time for compaction, and in some cases, no doubt, these complaints are justified.

About 50% of the roads are in side-hill country and on these roads wide ditches are built on the upper side in order to prevent the scour that takes place in deep ditches. The water collected in these ditches is taken across the road and distributed to natural watercourses on the lower side. Rock foundations are put in where absolutely necessary, but great care is taken not to put them in where they are not necessary. It is better to tear up sections where there are faulty foundations and put in stone than it is to put down unnecessary stone foundations at the time of construction; and it costs but very little more for the particular section involved and much less for the entire road. If a course of gravel 8 or 10 in. deep is put down and covered with a 6-in. gravel top, the frost will lift it as a whole. If the bond is good it will take very heavy traffic and will give an easy riding road. Even with good drainage a rock base will become clogged and one rock after another will work up through the surface.

Screened gravel is not being used for the reason that the money available does not justify the heavy cost that screening would involve in view of the fact that the unscreened gravel available binds well and gives a good surface. Screening is necessary when building for heavy traffic, but to date thousands of miles of secondary trunk roads have been built and maintained with ordinary gravel. Some of them were built in 1917 and are carrying from 300 to 400 cars a day and are giving excellent results

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

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THE HIGHWAY CONTRACTOR AND ROAD BUILDER

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NEW YORK, N. Y., JUNE 22, 1921

Number 25

Crushed Stone and Gravel Roads *

Practice in Pacific Northwest—Two-Course Construction, with Screened Gravel, Gives Best Results—Crushed Gravel Preferable When Watering and Rolling are Omitted—Dragging and Maintaining Surface During Construction Very Important—Water Should be Used when Obtainable

By C. L. McKESSON and A. F. MORRIS†

The fact that for many years an extensive mileage of highways must of necessity be surfaced with crushed stone or gravel seems to warrant a review of developments in this type of construction in the Pacific Northwest. This paper does not take into consideration macadam surfacing, which is an altogether different type.

Many miles of crushed stone or gravel surfacing are now under construction. Due to a lack of water in most localities where this type is being built, water has been used on only a few projects and rolling is seldom resorted to. The general practice now in this section is to use much finer material than heretofore, both in bottom and top courses. The maximum size of material used is 2 in., and on many of the most satisfactory pieces of construction 1½ in. was fixed as the maximum. The ease with which such a surfacing may be maintained and the smooth, uniform roadway resulting seem to justify the small additional cost involved in producing the finer material.

The more recent specifications for crushed stone or crushed gravel surfacing usually require the material to be screened into two bins, one receiving the material from 2 in. or 1½ in., the maximum size, down to 1 in. or ⅞ in., and the other containing the finer material. The material is spread in two courses, each approximately one-half of the total thickness, but the exact thickness is regulated in such a way as to use all of the material between 1½. and 1 in. (or ⅞ in.) for the bottom course and the finer material for the top course. The base course is usually spread about 500 ft. in advance of the top course, but this is varied in order to prevent the overflow of either of the bins.

Specifications Give Satisfactory Results

The results obtained under these specifications have been satisfactory, but it has been noted that the stone from some quarries has set up into a smooth, hard roadway much more quickly than that from others. In some cases stone which screening and abrasive tests indicated as being of superior quality did not form as satisfactory road material as a softer stone on which a rather adverse report had been made by the testing engineer. It has been demonstrated that a small amount of soft stone in a quarry provides a binder which is far more desirable than earth or clay, which it is sometimes necessary to add to the base where the material is a particularly hard clean basalt.

On one project in central Oregon the specifications call for crusher-run material of a maximum size of 1½ in. laid in one course of 5-in. thickness and leveled up with a top course of approximately 1-in. thickness. The results are not as satisfactory as on other projects where the material is separated into two grades and laid in two courses. When laid in deep courses, the material does not compact as well as when laid in lighter courses, and the operation of spreading and dragging the stone tends to sift the screenings to the bottom and leave the larger fragments on top—exactly the reverse of the ideal condition.

In some specifications an attempt is made to specify percentages of material passing a series of screens between the maximum and minimum sizes. There appears to be little or no justification in practice for this attempted refinement. A gravel or broken-stone type of surfacing is at best only a light traffic surfacing and every effort should be made to use suitable materials locally available. In many cases splendid pieces of work have been constructed with material which would not comply with a specification requiring an ideal grading with a minimum percentage of voids. The maximum size should be specified at 1½ or 2 in. The maximum and minimum percentages of sand should be specified between liberal limits. The proportions passing and retained on a ⅞-in. or 1-in. screen should also be specified. These proportions can easily be checked on a large scale during the progress of the work by noting the relative output from each of the bins. The various pits should be carefully examined and average grading of the material, apparent cementing qualities, percentage of oversize particles and availability of material should all be considered in the selection of pits. The best material that can be obtained within reasonable costs should always be selected. In some cases it will be found necessary to use gravel, little of which is coarser than ¾ in. or 1 in., and some very satisfactory results have been obtained with such gravel, which of course requires no separation of sizes.

---

*From "Public Roads," official publication of the U. S. Bureau of Public Roads.

†Senior Highway Engineer and Highway Engineer, respectively, U. S. Bureau of Public Roads.

Crushed Gravel Most Satisfactory For Dry-Built Roads

Where surfacing is laid without water and without rolling, crushed gravel has generally been found to be the most satisfactory material. The selection of gravel pits requires care and experience on the part of the engineer. As a rule any gravel which is found cemented together in the pit will form an excellent road metal when crushed and properly laid, while gravel which lies loose in its natural state, as in beds of streams, or which carries a large amount of sand, can not be expected to set up rapidly when deposited on a road, though there have been some exceptions to this rule. The gravel, though lying loose and free in the bank, may carry enough soft granite or other soft stone to form a natural binder when crushed, but as a general rule, unless the material is found well cemented in the pit, it will not prove satisfactory as a surfacing material where the oversize gravel and excess sand is screened out and no crusher used. Such material will not compact into a good wearing surface in dry weather without the addition of clay or earth binder. Where such binder is used the results usually appear to be satisfactory in the summer, but when the clay, which acted as a binder in August, becomes a lubricant in January, the results are apt to be far from satisfactory. It is very desirable to crush oversize material rather than to screen and waste it. Any gravel which contains 15 to 20% of oversize material will justify the use of a crusher.

A number of projects have been constructed with gravel spread in two layers, each of approximately one-half the total thickness, the material in both the top and bottom courses being required to pass a 1½-in. screen. In Washington it has been the general rule to specify "one-course" gravel of a maximum size of 1½ in. While the specifications permit laying the total thickness (which varies from 6 to 8 in.) in one course, it has been the general practice to spread a base course of approximately one-half the total thickness and follow with a second layer of the same size material, as it has been found easier to operate trucks in this way than to plow through 6 or 8 in. of loose gravel.

The Most Satisfactory Method

After observing the methods employed in the construction of the various types of crushed rock and gravel surfacing on many federal aid jobs in District 1, and the results obtained, we are convinced that the most satisfactory road surface has been secured where the crushed gravel was placed in two courses; the bottom course consisting of material passing a screen with circular openings of not more than 2 in., preferably 1½ in., and retained on a screen having openings of 1 in. or ⅞ in. diameter and the top course consisting of all material passing the smaller screen.

There is some difference of opinion as to the merits of this method of screening into two sizes before laying. Some engineers argue that it is better to use crusher run material in both courses on the theory that in this way the voids in the base are filled better than if the fines are screened out. If it were possible to obtain a uniform mixture and to maintain this uniformity through the various stages of crushing, screening, hauling, and spreading the rock, there would be no doubt that the crusher-run method would be the more desirable, but it is not possible to secure the desired uniformity when all the output of the plant falls into one bin.

When the material falls from the screen, the fines cling together in a pyramid, while the larger pebbles and fragments roll down and outward to the sides of the bin. The result is that some loads hauled to the road contain practically all fines, whiles others consist almost entirely of the larger size stone; so that the theoretically uniform mixture actually consists of a patch of coarse and a patch of fine, with the fines on the bottom and the coarse material on top quite as frequently as otherwise, which is exactly the reverse of what it should be.

Even if every load were uniformly graded and mixed when deposited on the road, which they never are, the process of spreading and dragging necessary to secure a true and uniform surface would tend to

(Continued on page 324)

GOOD ROADS
CONSTRUCTION TRANSPORTATION MAINTENANCE

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Copy for advertisements must reach the New York office by noon on Tuesday of the week before date of issue if proofs are to be submitted.

Copy for classified and other advertisements where proofs are not required will be accepted until noon on Monday of the week of issue.

Articles by road builders are solicited. They should be short and, if possible, accompanied by photographs. Those accepted will be paid for at current rates.

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SISSON FOR SAFE ROADS IN NEW YORK

Highway Commissioner Sisson of New York State has declared himself in favor of safe highways, according to a recent report from Albany. In the state highway program this year, it is said, especial attention will be given to grade crossing elimination.

This will be welcome news to all who have given any thought to the conditions that are responsible for the appalling toll of lives exacted upon the highways of the country. One of the chief of these causes is the unprotected grade crossing. During the years of 1917, 1918 and 1919, according to widely quoted statistics, 5,605 people died of injuries sustained in crossing accidents and 14,063 others were injured more or less seriously.

The grade crossing, however, is not the only cause of highway fatalities and minor accidents. The reckless driver and the careless pedestrian are even more to be blamed. And their elimination is a greater problem than the elimination of the grade crossing—or its safeguarding—though it is primarily the concern of other than the highway department authorities.

In addition to grade crossings, there are many lesser sources of danger that do come within the scope of the highway engineer's work. Curves, embankments, grades and certain surface conditions are among them. Doubtless Commissioner Sisson's program takes cognizance of such matters and includes provisions for every possible safeguard for the constantly increasing army of road users.

The responsibility for providing roads than can be used safely rests squarely upon highway engineers and officials, but the responsibility for enforcing a safe and sane use of them lies elsewhere.

FUSSY METHODS AND SPECIFICATIONS

Hit or miss methods have caused endless trouble in the road work of past years. Now there is more than a possibility that the pendulum is swinging too far in the other direction—that present-day road builders are exhibiting a tendency to be over-precise in construction details.

References to this phase of highway engineering have been made in this column before. [See "Too Great Refinements in Road Building Specifications," Oct. 20, 1920, and "Unnecessary Tests for Bitumens," Nov. 10, 1920.] As was indicated in those two discussions, there is ample evidence that highway engineers are aware of the tendency to place too much emphasis on certain details and are making an effort to eliminate some of the useless requirements that burden road builders and taxpayers.

Among those who have made protests are state highway department engineers, contractors, engineers connected with material producing companies, and others who are in positions to observe the development of practice and to form worth-while opinions from their observations. One of the latest references to this matter was made in an article by two highway engineers of the U. S. Bureau of Public Roads, C. L. McKesson and A. F. Morris, which was printed in "Good Roads" of last week. In discussing the building of gravel roads in the Northwest, the writers made the following statement:

> In some specifications an attempt is made to specify percentages of material passing a series of screens between the maximum and minimum sizes. There appears to be little or no justification in practice for this attempted refinement. A gravel or broken stone type of surfacing is at best only a light traffic surfacing, and every foot should be made to use suitable materials locally available. In many cases splendid pieces of work have been constructed with materials which would not comply with a specification requiring an ideal grading with a minimum percentage of voids.

Gravel roads comprise one of the types in the building of which there is apt to be an attempt at too great refinement. The same tendency, however, is apparent in work with many other types, especially, perhaps, the higher grades.

Although there is ample justification for every intelligent, well directed effort to put highway engineering upon the same high plane as other branches of engineering, there should be a most careful avoidance of anything savoring of fussiness. Undue insistence upon minor details that add nothing to the service rendered by the finished road use up time and money, both of which should be conserved in order that the country's highway system may be made to yield the maximum of transportation within a reasonable time.

Road Work in Pennsylvania

During the present year approximately 160 mi. of roads have been built by the Pennsylvania State Highway Department. During the week ending June 15 the department broke all its previous records by completing 29.13 mi. of highways. On June 15 there were in the state 231 jobs under way, involving a total of 934.73 mi. and a total contract price of $51,731,523.

Highway Legislation in Connecticut

During the recent session of the Connecticut Legislature, which adjourned on June 8, a number of measures pertaining to highways were passed.

For new highway construction $2,600,000 was voted and changes in the motor vehicle laws are expected to make about $6,000,000 available for road maintenance and repair. Jitney buses were placed under the supervision of the Public Utilities Commission. The street railway companies were relieved of a great part of their street paving costs. The general motor vehicle law was overhauled and fees raised, loads and weights restricted and the use of highways by pedestrians in a reckless manner made unlawful.

Keller and Rountree Tilt

Governor and State Highway Engineer of Alabama Discuss Testimony of Townsend Witness

In asserting before the Committee on Post Offices and Post Roads at a hearing on the Townsend Bill that the "road from Mount Pinson to Birmingham (Ala.) is so rough that a milkman states that he starts with sweet milk and when he gets to Birmingham it is buttermilk," J. Asa Rountree, Director-General of the U. S. Good Roads Association, etc., has incurred the wrath of W. S. Keller, State Highway Engineer of Alabama. Mr. Rountree spoke in favor of the Townsend Bill.

In denying the truth of Mr. Rountree's general testimony, Mr. Keller declared it is to be "false" and "absolutely untrue" and characterized it as illustrating "his ignorance of Alabama conditions and law."

A telegram from Governor Kilby of Alabama, sent to Senator Heflin and read into the record, follows:

"Before taking too seriously testimony of Rountree, I suggest, unless you are already posted, that you investigate record of Rountree in Alabama and elsewhere with special reference to his methods of raising funds for the United States Good Roads Association. You may rely implicitly on testimony of Mr. Keller."

Crushed Stone and Gravel Roads

(Concluded from page 322)

work the fine material to the bottom, leaving the coarser particles on top, thus again producing a condition exactly opposed to the ideal, which is more nearly obtained by first laying the heavy rock on the bottom and spreading a top course of fine material.

Importance Of Dragging During Construction

The great importance of constantly dragging and maintaining the surface of the roadway during construction is frequently overlooked. Surfacing is usually begun at the source of supply, so that hauling and trucking of material will be carried on over the newly placed stone until the job is completed. With proper dragging a smooth, uniform surface can be obtained by the time the project is completed, but without dragging the road becomes badly rutted and a rough, unsatisfactory job results. In dragging it has been found advisable to use a light drag in the early stages, gradually filling the ruts as they are formed. If a heavy drag is used which entirely fills the ruts, the trucks are obliged to plow new ruts, and a constant repetition of this operation results principally in an excessive cost for hauling and leaves a poorly compacted surface. With light drags gradually filling the ruts, the ruts are built up and soon traffic can be distributed over the surface.

On one Oregon project it was necessary to truck material over the new surfacing up to a distance of 11 mi. from the pit. Without proper dragging or water this job made a very poor showing for several months. Two water tanks were then provided, the gravel was kept damp and dragged with light drags, and the job carried to a most satisfactory completion. The cost for watering in this case was about $250 per mile, but upon completion a smooth and well compacted surface was turned over to the public in spite of the heavy trucking during construction. A blade or road planer is necessary to finish such a surface after it has begun to compact under the light drags.

On one project heavy wagon tires dragged over the ruts behind the trucks assisted in filling and compacting the material and in eliminating the ruts.

The advisability of continuing the practice of laying screened or pit-run gravel surfacing without sprinkling and continuous dragging is seriously questioned, except in the rare instances where water can not be obtained. It is true that in nearly every case a fairly good road surface has been secured after properly maintaining it through a winter, with the usual amount of moisture from rain and melting snow; but it is very seldom that such a surface becomes really satisfactory until it has been thoroughly wet down, either by natural means or by the use of sprinklers in the course of construction.

Where water is available the cost per mile for sprinkling and dragging is usually very small as compared with the satisfaction of having a firm, smooth surface as soon as the road is completed. The inconvenience of a loose, rutty surface for the first season, as is so often the case where water and drag are not used, may thus be avoided. The reduced cost of maintenance for the first year when a road is properly compacted during construction will probably offset the cost of water used.

Bridge Work in Indiana

Bridge construction planned by the Indiana State Highway Commission for this year will cost between $1,000,000 and $1,500,000, according to W. J. Titus, State Bridge Engineer.

Thirty-eight contracts are to be awarded by the Bridge Department as soon as plans are completed. Twenty-one bridges will be built to replace dangerous bridges on the highway between Terre Haute and Richmond. These will cost $650,000. It is also planned to eliminate several railroad grade crossings.

Road Funds in Florida

Just before the Florida Legislature adjourned on June 4, it voted a 1-mill state tax for roads. The revenue from this tax, added to the road funds from other sources, will make approximately $9,600,000 available for road work during the next two years.

Federal aid available to the state amounts to $2,900,000; the gasoline tax will yield about $1,200,000; the estimated net value of convict labor is placed at $1,000,000; the motor vehicle tax will yield about $3,000,000; a balance of $700,000 from the motor vehicle fee fund is now on hand, and the new 1-mill tax will yield about $800,000.

Backers of Dowell Bill Outwit Townsend Faction

States Will Lose Unabsorbed Federal Aid Unless Bill is Passed Within Two Weeks

With the attaching of the Dowell Bill, which was drafted by the American Association of State Highway Officials, to the Phipps Bill now before the House, the success of the passage of the Dowell Bill seems assured. The Phipps Bill provides for an extension of time to those states which have not taken up their allotments of federal aid funds by July 1 and if not passed before that date the unabsorbed federal aid funds will revert to the national treasury. This measure had already been passed by the Senate and sent to the House. If the House passes the amended Phipps Bill it will go into conference, and while Senator Townsend may be able to prevent its passage, senators from those states who will lose federal aid allotments are extremely unlikely to oppose the measure.

Vehicular Accidents Increase in New York City

During the month of May 116 persons were killed in New York City in vehicular accidents, as compared with 92 in May, 1920, according to an announcement by the National Highways Protective Association.

Pennsylvania Passes Licensing Law

On May 26 Governor Sproul of Pennsylvania signed an engineers' licensing law, patterned after the model law of Engineering Council. The new law becomes effective June 1, 1922, and does not exempt from its provisions corporations and partnerships. The bill was supported by chapters of the American Association of Engineers and was passed in the face of considerable opposition.

North Carolina Highway Commission Endorses Dowell Bill

The State Highway Commission of North Carolina, which state recently passed a $50,000,000 road bond issue, on June 3 passed a resolution favoring the Dowell Bill and opposing the Townsend Bill. A rumor had been circulated that the commission was in favor of the passage of the Townsend Bill and this action was taken to put the commission on record as being unequivocally opposed to the Townsend Bill.

The Council of State has approved the request of the commission for $10,000,000 to be used for road work for the year beginning June 1.

◆

Allegheny County, Pennsylvania, has a highway program involving an expenditure of $1,800,000.

The Connecticut House of Representatives on June 1 rejected the bill providing for the elimination of tolls on state highway bridges. The Senate had previously passed the measure.

A Citizen of Daytona, Fla., has given $150,000 for the construction of a bridge across the Halifax River, according to a recent press report. The bridge is to be a memorial to a deceased citizen.

Middlesex County, New Jersey, plans to spend $500,000 on road work during the present year. Several weeks ago the county sold $270,000 of road bonds and now is offering $262,000 of road bonds.

The Virginia Highway Department this year has awarded contracts aggregating over $1,000,000, according to Geo. P. Coleman, State Highway Commissioner. The contracts embrace 102 mi. of road and several bridges, distributed over 17 counties of the state.

Massachusetts Highway Association

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WILLIAM P HAMMERSLEY	Norwood
FRED B RICHARDSON	Brookline

Announcement

This section of the paper is open to members of the Massachusetts Highway Association for the discussion of matters directly connected with road interests. Members are requested to submit items of interest for use in this column.

Address all communications to GOOD ROADS, P. O. Box 2705, Boston.

Civilians are warned in a statement by the Massachusetts Civil Service Commission, that it will be a long time before any but service men can get a state or city job. The veteran's preference law, it says, is in operation, and under it no civilian can get a position so long as there is a veteran on the list and idle.

"There are so many veterans on the list they absorb the positions," the board says in its statement recently. It then goes on to say that while many civilians have filed applications to take the examinations, they will find it useless as "the long list of veterans" make it practically certain that no civilian will be reached "for some time to come."

The board says that not in years has there been so great a demand for places in the public service. It points out that during the last month more than 1,000 applications have been received.

These were seeking positions in the state service and in the City of Boston, but besides there were many other applications for places in the service of cities and towns in the district known as "Metropolitan Boston."

The new bridge across the Charles River at Cottage Farm will be constructed under the supervision of a commission which will also apportion its cost on the various cities and towns and counties affected, as a result of an amendment recently adopted by the Senate.

The commission idea was introduced after representatives of Brookline and Norfolk County had given notice that they would fight the original bill, which assessed $112,500 on Brookline and $37,500 on Norfolk County. The commission will be appointed by the supreme court and its decision will be final.

The portion of the bill affecting the other three bridges—at Western Ave., River St. and Arsenal St.— passed unchanged. Boston, Cambridge, Watertown, Middlesex County and the Metropolitan District Commission will share in the expense of all four bridges.

A demand by the Boston Development & Sanitary Co. for prompt financial relief from its 10-year contract with the City of Boston for disposal of garbage and ashes met with flat refusal by Mayor Peters, on the ground that an alteration of this contract would pave the way for abuses of other contracts and manipulation of bids by contractors.

About $29,700,000 is available for road and bridge construction work and maintenance in the New England states this year, according to the U. S. Bureau of Public Roads, which has made a canvass of the highway departments of the states.

In Massachusetts, the amount available is $8,000,000; in Connecticut, $8,000,000; in Maine, $7,500,000; in New Hampshire, $2,500,000; in Rhode Island, $1,7000,000; and in Vermont, $2,000,000.

The total available throughout the country is approximately $622,000,000.

The Boston Finance Commission has protested to Mayor Peters that most of the street repairing and street resurfacing done by the city forces is of an inferior quality, because much of the crushed stone used from local quarries is below the minimum standard of quality set by the Federal Government.

"This inferior quality of stone," stated the commission in a former report, "has been used apparently with the assent of responsible officials of the Public Works Department, and in some cases after a protest by subordinate officials that the stone was unsuitable for street construction."

Because of this alleged condition, the commission made these recommendations:

"1—That the Public Works Department establish a definite standard for crushed stone to be used in bituminous macadam and bituminous concrete street surfaces.

"2—That the Public Works Department provide in its laboratory the necessary apparatus to make proper tests of crushed stone to determine its hardness, toughness and abrasion."

The hiring of horses for the cost of buying them, the awarding of contracts without advertising for bids, and the receipt of unbalanced bids for other contracts are conditions that have been existing in the Boston Park Department, according to a report the Finance Commission has made to Mayor Peters. All these conditions, stated the report, involve M. McGinnis & Co., Jamaica Plain contractors.

"It appears from examination of the bills in the auditor's office," stated the report, "that M. McGinnis & Co. furnished two driving horses to the Park Department last year at $1 a day each, the Park Department boarding and maintaining the horses. The total paid for these two horses for one year was sufficient to have purchased two horses suitable for driving purposes." In consequence of this, the commission advised, "that driving horses for the needs of the department be purchased and not hired."

"An examination of the bills also disclosed," continued the report, "that M. McGinnis & Co., without competition, furnished the Park Department last year with large quantities of structural material, cinders and manure."

The report further stated that this company, after being awarded an advertised contract for furnishing teams last year, "in addition was allowed, without competition, to furnish trucks for a whole year, the bills for which in the summer months ranged from $500 to $900 a month. There appears to be no reason why the furnishing of these trucks should not also be open to competition." The commission specifically advised the Mayor to obtain competitive bids for furnishing motor trucks.

It was in connection with the bids this company submitted this year, in competition, for the teaming contract that the commission charged the company with filing unbalanced bids The commission explained that the Park Department called for bids for furnishing for a period of one year 12 double teams with dump carts and 5 single team express wagons each day.

The bids received were as follows:

	Price per Day	
	Double	Single
P. O'Riordan Co.	$7.30	$3.20
M. McGinnis Co.	7.00	2.00
John Kelley Co.	6.75	3.00
Fred H. Webster	6.65	3.35

To determine the lowest bidder, the Park Department multiplied the price bid per day by the number of teams in each class. This gave the following results:

M. McGinnis Co.		
12 double teams at $7.00	$84.00	
5 single teams at $2.00	10.00	$94.00
John Kelly Co.		
12 double teams at $6.75	$81.00	
5 single teams at $3.00	15.00	$96.00
Fred H. Webster		
12 double teams at $6.65	$79.80	
5 single teams at $3.35	16.75	$96.55
P. O'Riordan Co.		
12 double teams at $7.30	$87.60	
5 single teams at $3.20	16.00	$103.60

This showed that M. McGinnis & Co. was the lowest bidder. "There is no objection to this method," stated the finance commission, "but the bid of M. McGinnis & Company of $2 a day for furnishing a horse and express wagon with a driver obviously would involve a loss to the contractor.

"No plainer example of unbalanced bidding has been brought to the attention of the finance commission. In fact, all of the bidders seem in this respect to have submitted unbalanced bids. The fact that it is more marked in the case of M. McGinnis & Co. may be due to the knowledge which that company had that it would not be called upon to furnish the number of single teams called for by the Park Department in the advertisement.

"This company has had teaming contracts with the Park Department since Feb. 1, 1918, and its knowledge of the number of single teams required no doubt gave it an advantage in making its bids.

"The bills of M. McGinnis & Co. on file in the city auditor's office for the fiscal year 1920-21 show double teams employed for a total of 4190½ days and single teams for 590 days, a ratio of 1 to 7.1 instead of 1 to 2.4 as estimated by the Park Department in requesting the bids under discussion.

"If the Park Department took as a basis the total number of teams actually used last year, the bid of Fred H. Webster is lower than the bid of M. McGinnis & Company by the sum of $2,529.92. If 12 teams are to be furnished, not more than two single teams should be required, according to the experience of last year. In any event, it is clear that the bid of M. McGinnis & Co. is so unbalanced that it should be rejected, even if it were the lowest.

In conclusion, the commission advised the following of one of three courses: (a) That the contract for the present year be awarded to Fred H. Webster, or, (b) that all bids be rejected and new bids advertised for on the basis of single and double teams used last year, or, (c) that the award be divided, awarding the contract for single teams to M. McGinnis & Company at $2 a day, and the double teams to Fred H. Webster at $6.65 a day, the lowest bidders, respectively.

A committee composed of the chairmen of the various town boards employing labor in Wakefield is to ascertain by June 23, the wages paid in other towns and cities and the effect of the reduced cost of living, with a view to cutting wages in public works departments. At the conference, June 23, workmen in each department will be allowed to send two representatives to present their side of the case.

Fire of unknown origin early on the morning of June 17th destroyed a 500-ft. section of the Saugus River Bridge at the Point of Pines, separating Revere and Lynn, and only prompt work in opening the draw prevented the entire structure from being burned.

The destruction of the bridge in the middle of the summer season and on the morning of the holiday is a severe blow to motorists. The closing of the bridge will shut off traffic on much of the Revere Beach Boulevard. It is probable that the streams of automobiles that daily pass along this route will be divided at Broadway and sent over the highway along the Lynn marsh.

The flames were discovered by Drawtender William Murray, and destroyed the section from the Lynn side of the river to the draw. The sides and planking of the structure were burned, and the piles and underpinning so badly charred that it is probable that the section will have to be entirely rebuilt. Two alarms were sounded for the fire, one from Revere and the other from Lynn. Before the apparatus arrived, however, the draw had been opened thus preventing the flames from spreading to the Revere side and to the house on the draw. The Revere apparatus was unable to aid materially in fighting the fire.

The fire was under control at 1:30 o'clock.

It was only a few years ago that the Wellington Bridge, controlled by the same board, was seriously damaged by fire.

New York State Road Builders' Association

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Crusher Run

Commissioner of Highways Sisson has urged caution in driving over the state highways, as extensive construction and repair work is in progress. Roads are closed in practically every county in the state, according to the Highway Department.

A large part of Commissioner Sisson's highway improvement program has to do with making the roads safe for the traveling public. Especial attention is to be given to grade crossing elimination, it is stated, such work to be included wherever possible in the construction of new roads. There are 8,329 grade crossings in New York State, of which only 2,553 are protected.

An idea of the menace of the grade crossing can be obtained from the official statistics for the years of 1917, 1918 and 1919. During that period, the number killed or injured in grade crossing accidents in the United States was 19,668, of which 6,505 died of their injuries.

The letting held on June 3 was a very lively one, the bidders including several new contracting firms. There were 18 roads advertised for improvement or repair and 82 bids were received. The total amount involved in the work advertised was $1,625,747. No bids were received on the repair contract in Genesee County.

Cornelius Vanderbilt, who heads a contracting firm with headquarters at West New Brighton, S. I., was one of the new bidders. His company's bid was the lowest of seven for repair work on the Knapp's Corners-Nyack Road in Rockland County. The bid was $73,646.82 and the engineer's estimate was $84,602.70.

The largest contract awarded was for the reconstruction of the Madison-Bridgewater Road in Oneida County. It was awarded to the Lane Construction Co. at $322,818.50.

The Spellman-Oliver Co., Chateaugay, was the low bidder on the Norfolk-Raymondville job in St. Lawrence County, with a bid of $109,780.10. There were five other bidders.

There was another large letting on June 8, when 103 bids were received on 18 roads.

There were 12 bidders on the Fulton and Saratoga County Road, Brown, Low and Law Bros., Herkimer, being low with a bid of $359,165.50. The engineer's estimate was $407,163.50. The bid was rejected because the price on one item exceeded the unit price and the contract was awarded to Harry W. Roberts & Co. at $359,488.00. This road is a very important one, 11.31 mi. in length, and is known as the Broadalbin-East Galway Highway. Its improvement will be made by federal aid and, when completed, will open up a new route into the Mohawk Valley, cutting off 7 mi. of road distance between Johnstown or Gloversville and Saratoga Springs.

S. B. Van Wagenen, Inc., of Rondout, received the contract for the Kingston-Port Ewan, Ulster County, job at a bid of $43,597. The engineer's estimate was $49,264.

The Hendrickson-McCabe Construction Co., Syracuse, was awarded the contract for the repair job in Ontario County at a bid of $42,935. The job is 1.51 mi. long and the engineer's estimate was $50,730.

The New York State Road Builder's Association, through its attorneys, Brackett, Todd, Wheat & Wait, has advised its members that the second, and new, test case under the Knight Bill had been argued on May 20 before the Appellate Division of the fourth Department and that a decision could be looked for at the opening of the court at its next term early in July.

New Hampshire Good Roads Association

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The regular quarterly meeting of the New Hampshire Good Roads Association was held at Portsmouth, on Thursday, June 9.

The business meeting was held at the Piscataqua River Bridge Commission office and was called to order by President Smith at 12:30. About seventy-five members were present. An address of welcome was delivered by Division Engineer Grover of the New Hampshire State Highway Department at Portsmouth. Applications for five new members were received and acted upon favorably.

After a short business meeting, Mr. Grover explained the preliminary work on the new bridge over the Piscataqua River, telling the members of the various difficulties which must be overcome in order to complete this work which is one of the largest and most difficult bridge propositions known to the engineers to have ever been attempted in this part of the country. The river at the point where the bridge will cross is approximately 76 ft. deep. The foundation or caissons of the bridge are made on the shore and floated to their positions in the river and sunk. Very instructive drawings were on exhibition at the Bridge Commission office and the members had an excellent chance to see just how this work was to be carried on.

At 1:35 Mr. Tolles of Nashua made a motion to adjourn and the members retired to the Hotel Rockingham where luncheon was served.

The first speaker of the afternoon was Mayor Hartford, of Portsmouth, who extended a cordial welcome to all present. Ex-mayor Hislop, a member of the Governor's Council and a very active member of the Association, was the next speaker. Following Mr. Hislop, U. S. Senator George Moses, of Portsmouth, was introduced and received an enthusiastic ovation. Senator Moses spoke favorably of the Townsend Bill and informed the members that no doubt within a few days he would be able to bring back glad news that the bill has been passed and that the State of New Hampshire would receive approximately $500,000 of federal aid money for highway work.

Senator Whittemore, of Dover, was the next speaker. He outlined to the members the difficulty of obtaining money for good roads during the early stage of the automobile when the people in the outlying districts were not in favor of expending large sums of money to assist automobilists. Senator Whittemore did not approve of the State of New Hampshire spending money received from the Townsend Bill under the supervision of the Federal Government.

F. E. Everett, State Highway Commissioner of New Hampshire, delivered a short address on the progress made in the past few years on state work and highway work in the city of Portsmouth and the State of New Hampshire in general.

Mr. Rollins of the firm of Holbrook, Cabot & Rollins, bridge builders, who are constructing the Piscataqua River Bridge, was the next speaker, and, with the aid of charts and maps, explained to the members further construction details. He informed the members that there was but one other bridge of this type east of the Mississippi River and that the one at Portsmouth would be the largest of its kind in the country.

Other speakers included Commander Brownell of the Portsmouth Navy Yard and Captain Adams of the Industrial Department in the Navy Yard. The members were invited to visit the yard by commander Brownell.

The meeting adjourned at 2:30 and the members then boarded the Navy Yard tug at the Portsmouth Transportation Wharf and visited the Navy Yard and were shown some of the important work performed there, including the submarine work, machine shops, boat shops, etc. There was also on exhibition a German submarine U-111 which several of the members took the opportunity of inspecting very thoroughly. The party left and took a very pleasant sail around Portsmouth Harbor, the Isle of Shoals and other points of interest, returning at 7.

Maine is finding cause for congratulation in the reduced cost of road making. The Portland

"Evening Express" reports that this year, in the Town of Gray, state highway will be built at a cost of $35,000 a mile as compared with a cost of $48,000 for the section built last year. On another road project, work has been contracted for at a price of about $22,000 a mile, which is little more than half what was paid for work of the same character last year. These marked declines in cost are due both to the fall in the price of materials and in wages. The Portland newspaper finds that there is this year an abundance of help, and that it may be hired at reasonable rates. It means not only a great saving in the cost of construction, but it permits also the shortening of the time when travelers must make detours in order to pass the places where work is in progress. That is a fact of interest to the thousands who flock to Maine during the vacation season.

Regret is expressed that the Maine Highway Commission is not in a position to undertake an unusual amount of work in order to obtain greater benefit from the existence of a surplus of labor. Were such a course possible, it might aid in improving the industrial situation as well as in saving money, but Maine, like other states, must cut the garment to the cloth, even with the knowledge that were there more cloth it might be a better garment. As it is, while Maine roads are often far from perfect, the state has made no small progress in providing a system of modern highways, an accomplishment in which there is exhibited an intelligent self-interest.

Maine knows that in these days of automobiling it is essential to her standing as a vacation state to make automobiling easy. Whatever facilitates road making in Maine is a matter of importance to thousands of the people of other states. News of the reduction of construction cost down east is therefore of interest elsewhere quite apart from its significance as bearing on the trend of prices in general.

The contract for the engineering on the new Amoskeag Bridge in Manchester has been awarded by the Highway Commission to the Fay, Spofford & Thorndike Co., of Boston, and it is confidently expected that plans and specifications will be completed early in July and that the bridge will be ready for traffic on or before Dec. 1 of this year.

The new bridge will have a 20-ft. roadway and a 6-ft. sidewalk. It will be of steel, with a concrete deck, and the piers which supported the old bridge will be utilized. The bridge will be about 22 ft. above the railroad track and will be constructed to grade on both sides of the river, thereby saving the cost of building approaches.

In planning the bridge care will be taken to build the structure heavy enough to accommodate street car traffic if necessary and wide enough to allow the laying of tracks without decreasing the width of the roadway to an extent that would prove detrimental to automobile traffic.

The Fay, Spofford & Thorndike Co. will draw the plans and specifications for the bridge and will supervise the construction. The contract as awarded carries the usual commission to the engineers and has been approved by the Finance Commission.

The engineers were recently in Manchester and at a joint session of the Highway Commission, the Finance Commission and the city solicitor the entire project was thoroughly discussed and the contract awarded. The engineers will make ample provisions for lighting the structure and the fixtures will be so built that the bridge will be well lighted at all times.

The engineers will have supervision of the work until the bridge is opened for traffic.

Judge Edgar Aldrich of the United States district court, who was largely responsible for the naming of the Daniel Webster highway, has written a letter to the state highway commisioner in which he urges the marking of the highway in a substantial manner. He expresses approval of the proposal to mark the highway by colored bands placed upon telephone poles along the route and suggests that the state accept granite markers now being prepared as a gift to the state and that these markers be placed on the New Hampshire side of the Massachusetts boundary. It is also suggested in the judge's letter that these granite markers bear appropriate inscriptions and he offers to take the matter up with the governor and council when the granite markers are ready for delivery. It is the judge's suggestion that one marker bear the inscription "The Daniel Webster Highway" and that the other carry the words from Webster's famous Bunker Hill oration, "Our country, our whole country, and nothing but our country."

Trees along the Webster highway may honor every soldier, sailor and marine of New Hampshire if a proposal of the American Legion, to be set forth at coming meetings of the local posts, is carried out. The project, which it is proposed to launch here, is similar to one which is being advocated throughout the country, the full success of which would mean that the great Lincoln Highway from New York to San Francisco and the Dixie Highway from Chicago to Florida would be fringed with shade trees. A permanent marker would be placed on each tree, bearing the name of a service man and his organization, without indication of rank. Special markers would honor those who died in the service. The plan has the approval of President Harding and the United States Forestry Bureau has promised its aid.

The scheme is believed here to be much more practical than that of naming city squares in commemoration of those who died in the service since there

(Concluded on page 332)

EQUIPMENT--TRADE--MATERIALS

Wallis Tractors

Not only is labor saving machinery performing the work of constructing and maintaining the higher types of roads, but it is also being used extensively in grading and dragging earth and gravel roads. Where horses or mules were formerly used to haul machinery, tractors are now used.

WALLIS TRACTOR USED IN MINNESOTA

In the accompanying illustration is shown one of the two Wallis tractors used on road work in Martin County, Minnesota. This tractor recently covered 4,500 mi., in seven months with no repairs and without changing spark plugs. These tractors in Martin County pull 8-ft. graders, heavy duty drags and 18-ft. planers with three blades.

In Marion Township, Mercer County, Missouri, a Wallis tractor was used last year for maintenance work and a considerable saving over former costs effected.

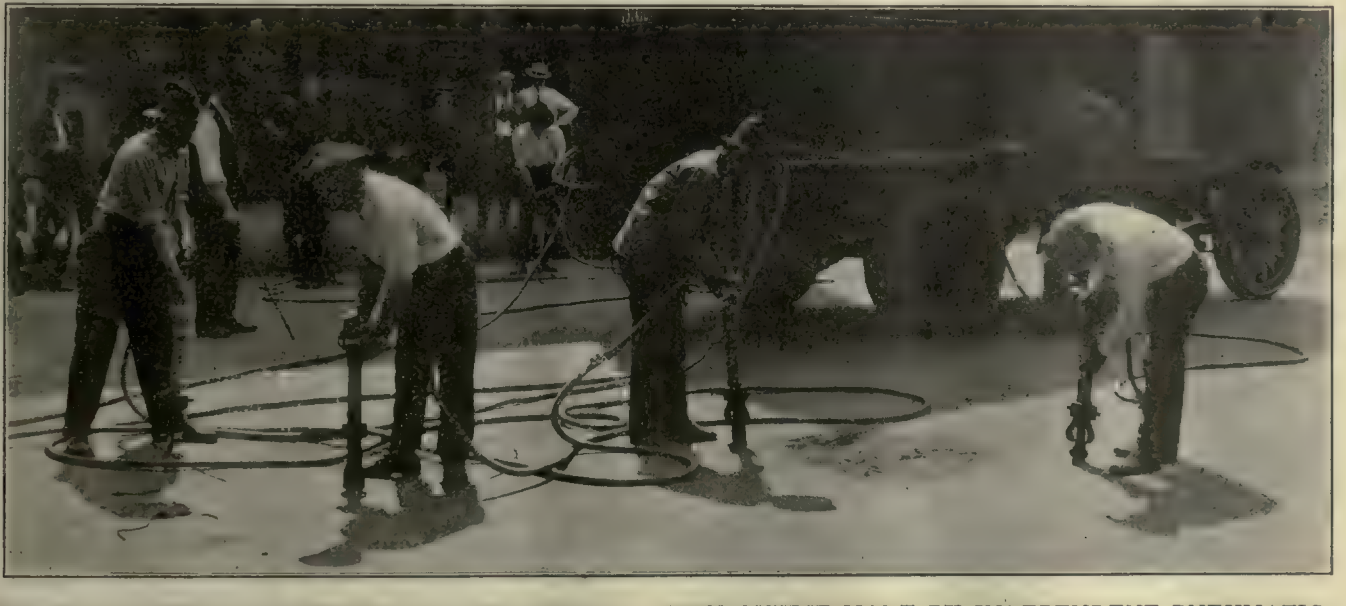
"We started grading," said C. W. Cunningham, Township Trustee, " with the Wallis tractor on June 25, and after operating the grader 35 days, have completed 90 mi. of road. Some of it is road that we have never been able to grade with horses. Our total expense during this time for fuel, oil and labor has been $15 per day, or $525."

Pneumatic Pavement Breaker

The Bureau of Streets of the City of Chicago, Ill., is using a portable compressor outfit and pneumatic riveting hammers for cutting and repairing asphalt pavement, as shown in the accompanying illustration. The outfit consists of a portable air compressor and tank mounted on a motor truck. The compressor is driven by the motor of the truck and is equipped with air lines for six pneumatic tools.

The hammers used are No. 90 "Thor" fitted with spade-shaped chisels. These hammers are fitted with safety inside triggers and spring retainers which hold the chisels in place and also act as depth gauges.

A gang of six men with this outfit, it is said, can accomplish more repair work on asphalt paving than can 30 men using sledges. This outfit was perfected by Thomas H. Byrns, Superintendent of Streets of Chicago, and is manufactured by the Independent Pneumatic Tool Co., Chicago, Ill.



REPAIRING ASPHALT PAVEMENT IN CHICAGO, ILL., WITH OUTFIT MADE BY INDEPENDENT PNEUMATIC TOOL COMPANY

MEETINGS

Calendar of Coming Events

June 20-24—American Society for Testing Materials—Twenty-fourth annual meeting, Asbury Park, N. J. Secretary, C. L. Warwick, Engineer's Club Bldg., Philadelphia, Pa.

June 28-July 1—Society for the Promotion of Engineering Education—Annual convention, New Haven, Conn. Secretary F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Aug. 30-Sept. 1—Michigan State Good Roads Association.—Annual meeting, Flint, Mich. P. T. Colgrove, Pres., Hastings, Mich.

Oct. 24-28—American Society for Municipal Improvements—Annual Convention, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

PERSONAL MENTION

Frederick C. Horner, transportation engineer with the Packard Motor Co., is going to Europe for two years to study transportation practice.

J. S. Bright, formerly a district engineer of the U. S. Bureau of Public Roads at Denver, Colo., has been transferred to San Francisco as assistant to Dr. L. I. Hewes.

Charles M. Upham, State Highway Engineer of Delaware, has been granted a leave of absence to become chief engineer of the North Carolina State Highway Department.

U. L. Fisher has been appointed maintenance engineer of the 7th District of the North Carolina State Highway Department. Mr. Fisher was formerly a resident engineer in the 2d District.

J. W. Ball has been assigned to the regional headquarters of the U. S. Bureau of Public Roads at San Francisco. Mr. Ball has been a construction engineer with the bureau for the past seven years.

Eugene Gedney, contractor, of Cleveland, Ohio, has been awarded a contract for the construction of ten bridges in Cuyahoga County. Mr. Gedney was an assistant county engineer with the New York State Highway Department for ten years, leaving that work to become an assistant engineer in the Valuation Department of the New York Central R. R. at Cleveland and later engaging in the contracting business.

New Hampshire Good Roads Association Notes

(Concluded from page 330)

are thousands of trees where there are only hundreds of squares and there would, therefore, be no distinction made in paying homage to the men who fought under the colors of the United States.

Repairing and resurfacing of Manchester streets is being done at an exceedingly low cost, according to figures secured through the Highway Commission. The Robie Concrete Construction Co., which is at present engaged in filling up the holes and assisting in the resurfacing being carried on, has quoted a price which is considered to be far less than is being paid in other municiualities for the same work.

The figure quoted by the Robie Company to the highway commission is 70 ct. per yard, the company furnishing the asphalt. The same company is being paid 75 ct. per yard for doing the same work on the state highways and the state is furnishing the asphalt. The reason for the low price quoted is said to be the location of the plant near the city.

Approximately 100 mi. of road in Manchester have been put into condition this spring by the Highway Department and its employees and at a reasonable price. In fact, other concerns who have been approached in regard to the matter of street repair have refused to consider the proposition at anywhere near the figure set by the Robie Company.

It is said that there have been some complaints on account of the work being done without sending out requests for bids, but the commissioners say that the company now at work on the streets has quoted a price which is far below that which would be quoted by other contractors.

The largest part of the resurfacing and repairing has been done within the Highway Department itself, and the commissioners say that no large contract will be considered without requesting bids on the proposition. According to the city clerk there is no law which requires such procedure, but it has always been customary, and is considered by the commission as the only way to authorize a construction proposition.

A new steel bridge being built across the Connecticut River at Brattleboro, Vermont, collapsed June 16. A working party of 53 men were on it when it went into the river, but all were saved. Those in charge of the construction for the American Bridge Company, of Elmira, N. Y., said that the collapse was due to the snapping under water of piles that were set to carry a much heavier load than that under which they failed.

The bridge which was being built to replace one that went out with the ice a year ago, spanned the river from Brattleboro to Island Park, N. H. The new span measured 330 ft.

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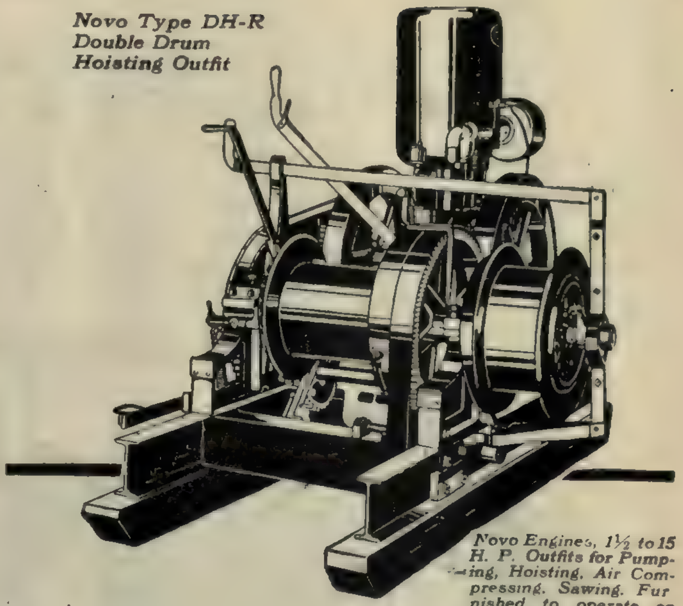

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Old Series, Vol. LX
New Series, Vol. XXI
NEW YORK, N. Y., JUNE 29, 1921
Number 26

Highway Researches and Their Results-I *

Need of Information on Behavior of Various Pavement Types on Different Subgrades and for Data as a Basis for Rational Pavement Design—Description of Series of Tests and Studies being Conducted by the U. S. Bureau of Public Roads

By A. T. GOLDBECK †

The necessity for research in highway engineering has been given a very general recognition throughout the country and various agencies are now at work on different phases of the many problems in an effort to gain the information necessary to permit successful and economical design of our highways. I propose in the present paper to deal only with the researches now being conducted by the Bureau of Public Roads. It has seemed to us as the road situation is lined up today that we are lacking in some of the very fundamental facts underlying road design. By observation of existing roads and of their failures, our judgment has been schooled to a certain extent and we can at least decide approximately what constitutes an inadequate design under certain known conditions. With our present knowledge, however, it is practically impossible with the given traffic predicted and with a given set of subgrade conditions and other controlling factors, to make any very accurate decision as to the relative suitability of different types, or even as to the adequacy of one type. In the meantime we have an enormous amount of motor traffic to take care of. There is pressing need for roads to carry this traffic and the work of road construction must, therefore, proceed for the present based on the best judgment we can bring to bear upon it, but in the meantime we must gather all the facts possible, by observation and by research, which will lead us in the end to some way to augment our judgment. In the end we hope that we shall be led into just as rational a method for designing our roads as we now have for designing our bridges.

In the present situation, then, it would seem to us that highway research must take two paths. We need research which will give us approximate but reliable indications of how our various road designs behave on various types of subgrades when subjected to known traffic. In the meantime we must make a start on researches to establish some important underlying and fundamental facts which will finally lead us in the direction of some system of rational design. The researches now being conducted by the Bureau of Public Roads are designed to give results in both of these fields of investigation. Last year I described before this association some of the experiments then being carried on, and indicated briefly some of the results then obtained. I wish to make the present paper a progress report in which the main results and indications will be brought up to date and any new tests not previously described will be touched upon.

Tests of Impact of Motor Trucks on Roads

It will be recalled that one of the investigations described in the previous paper was that of the measurement of the impact delivered by motor trucks on the road surface. The method of measurement has remained unchanged, and consists in allowing the rear wheel of a motor truck to deliver a blow to the plunger of a hydraulic jack buried under the road. The blow is transmitted to an especially prepared copper cylinder, the deformation of which is taken as a measure of the intensity of the blow. By calibrating similar copper cylinders in a testing machine, and comparing the deformation of the cylinder under impact with the deformations resulting from static pressures, it is possible to express the intensity of the impact blow in terms of equivalent static pressure. This method of expression, and

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*Paper presented at the 1921 Convention of the American Road Builders' Association, Chicago, Ill.

†Engineer of Tests, U. S. Bureau of Public Roads.

this method of testing, although inaccurate furnish us with a means for finding out approximately the magnitude of the blows delivered by the various kinds of trucks, and give us an idea of their relative intensity. Since reporting the tests last year several thousand additional tests have been run. It will be impossible to do justice to the results at the present time, but as a paper on the subject will appear in the March issue of "Public Roads" the details and figures may be obtained by reading them in the forthcoming magazine. I do wish to present in brief, however, a few of the more striking and significant results.

It will be readily understood that a number of factors control the impact delivered by motor trucks to road surfaces. Among these factors should be mentioned:

a. Weight of truck and its division into sprung and unsprung weight.
b. Tire equipment.
c. Speed.
d. Spring characteristics.
e. Unevenness of the road surface.

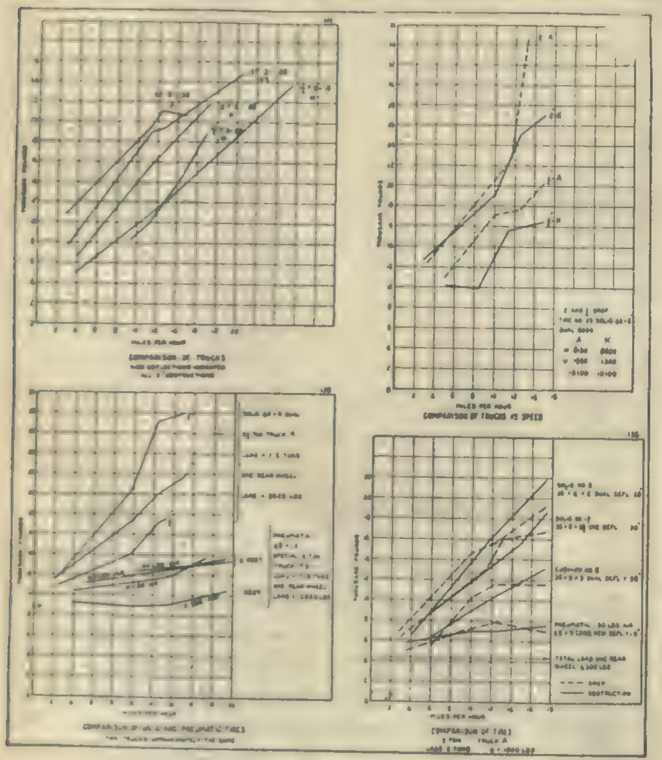

FIG. 1

Considering first the weight of truck, Curve 141 will give some idea of the relative impact exerted by a 1½-ton truck, a 3-ton Army truck and a 5-ton truck of standard make. In this particular curve the trucks mounted over a 2-in. obstruction placed on a weighing device and the impact is that of a single rear wheel. Note that for corresponding speeds the impact of the heavy truck is much greater than that of the light truck, and roughly the impact of the 5-ton truck is double that of the 1½-ton truck. The light truck is capable of higher speeds than the heavy truck, and it will be noted that at high speeds the light truck delivers as severe an impact as the heavy truck at its slower speed. At the present time I do not interpret these results to mean the light truck does as much damage as the heavy truck.

The effect of tire equipment in reducing impact is very plainly shown in Curve 136. These results were obtained by equipping a 2-ton truck with different kinds of tires, and using exactly the same height of obstruction in all cases. The tires used were two types of solid tires, a cushion tire and a pneumatic tire, and the deflections of these tires are noted on the curve. The deflection is the amount of flattening of the tire under the weight on one rear wheel of the truck, in this case 4,500 lb. The interesting point to be noticed is the very high impact delivered by the truck when equipped with solid tires, as compared with the impact when equipped with pneumatic or with cushion tires. Apparently when equipped with pneumatic tires the impact is but very little more than the static weight alone, but with solid tires at high speed we may get an impact five times as great as the static load. At a smaller height of obstruction naturally the impact delivered would be considerably less than shown on this curve, but a 2-in. inequality is not an uncommon thing in some roads and at high speeds it is quite common for the wheel to leave the road surface by as much as 1 in. There is a striking difference between the impact of trucks when equipped with pneumatic tires as compared with the impact when equipped with solid tires. So far as we have gone, the experiments indicate very strongly that if our trucks, especially the lighter ones running at high speeds, were all equipped with pneumatic tires, we should have less destruction of our road surfaces and, in fact, if we could equip our heavier trucks with pneumatic tires no doubt much of the present destruction of road surfaces might be avoided. We realize, of course, that there are other factors that must be taken into consideration besides that of the destruction of the road surface, but I do wish to emphasize very strongly that the better we cushion the blow of the truck wheel the less will be the destroying influence; and apparently the cushioning of the blow is an inverse function of the static deflection of the tire.

The same curve, No. 136, shows the effect of speed. When the impact is caused by an obstruction it is seen that increased speed increases the impact. In the case of the wheel falling from one height to another, increased speed increases the blow up to the speed beyond which the wheel falls freely. Beyond this speed the impact is not affected by the increase in the speed. It is to be noted that with pneumatic tires some of our tests indicate no higher impacts at high speeds than at low speeds.

Up to the present time we have made no investigations of the effect of the truck spring although we have made tests of trucks equipped with different springs. I shall leave the discussion of the spring effect to the future. The question of the distribution of the weight of the truck between sprung and unsprung weight requires a few words of explanation. By unsprung weight is meant the weight of the truck beneath the springs and the sprung weight is the weight carried on the springs. The trucks differ not a little in their design, so that some trucks have lighter unsprung weight than others. This feature, therefore, entered into our investigations. We are trying to find not only the amount of impact delivered by motor trucks, but we are interested in knowing the cause of this impact. In curve 140 are given impact results in which two trucks, one having a heavy sprung weight of 1,950 lb. and the other having light unsprung weight of 1,300 lb. were loaded with the same gross load on each rear wheel, this load being 10,000 lb. One half-inch and two 1-in. drops were used in these tests, the truck wheel falling these distances onto the weighing device. Exactly the same tires were used in these tests so that this variable was eliminated. The springs were standard for these particular types of trucks. As indicated in the previous paper (see 1920 "Proceedings") results here shown still point to a lighter impact from trucks having light sprung weight, but it would seem that with the difference in design of trucks now existing, the difference in impact effect although noticeable, would have practically no influence on the design of the road surface. At this point it might not be amiss to call attention of the motor truck designer to the desirability of at least looking into the possibility of redesigning the truck with the idea of saving the road surface, or to at least consider the feasibility and economy of such a design. I take it that the road engineer and the motor truck engineer, representing respectively, the maintenance department and the department of mechanical equipment of our highway transportation systems, are both vitally interested in the same objective, that of the most economical transportation over our highways. If I may, I should like to urge the engineers of the two departments to get together and determine how to promote economy in highway transportation. Is the ultimate aim to be accomplished by the design of a more efficient unit of rolling stock that will require extremely heavy road construction and that will work rapid destruction of our lighter roads, or, does ultimate economy in transportation require a redesign of the motor vehicle having in view the less rapid destruction of the highways? These are problems in economics. Would it not be well for the motor truck engineers and the highway engineers to get together at the earliest possible moment and see what must be done to arrive at a correct solution?

The Effect of Impact on Road Surfaces of Different Design

Last year there was described before this organization an impact test being employed by the Bureau of Public Roads to simulate, as nearly as possible, the effect on roads of the impact of the rear wheel of a 5-ton truck. It was stated that a number of slabs 7 ft. square were laid on the subgrade in duplicate. Part of these slabs were laid on a subgrade which was purposely kept wet, and part on a subgrade that was drained as well as possible. A large number of these slabs have been tested to destruction with the impact testing machine which has been described a number of times. It consists of a weight of 1,800 lb. shod at the bottom with a 12-in. solid rubber tire, and upon which is mounted a 5-ton truck spring carrying a 6,000 lb. weight. The weight below the spring corresponds to the unsprung weight of a 5-ton truck and the weight above the spring to the sprung weight. The entire weight, sprung and unsprung, is raised and allowed to fall repeatedly on the center of the various test slabs; 500 blows are repeated at the height of $1/8$ in., and thereafter 500 blows are delivered at various heights increasing successively by $3/8$ in. until a height of 2 in. is reached, or until destruction of the slab occurs. It is interesting to note the relative resistance of the various types of construction to blows of this machine. Let it be pointed out that the impact delivered by a very light weight brought to rest in a very short time may be the same as that delivered by a very heavy weight brought to rest in a comparatively long time. For instance, the pressure created by a sledge hammer striking a concrete slab a severe blow may be the same as would be produced when a rubber cushion is interposed between the concrete and a very heavy weight falling a small distance. Although the maximum pressure reached may be the same in both cases the effects will be vastly different, due in part to the rate of application of the load, and in part to the difference in inertia of the moving weights. In making impact tests, therefore, it is very important that the tests be made not only with the specimens supported as they actually are in service, since the inertia of the body struck greatly influences the impact, but the striking body must also not only be of the same weight, but it must move at the same vertical speed and be rebounded at the same rate as the motor truck wheel delivering the impact to the road surface. Since we recognize these principles we are very careful to duplicate service conditions as much as possible in conducting the present series of impact tests. We feel that any departure from these principles would lead to erroneous results. The results of the tests of slabs laid on a wet subgrade are shown in Figs. 2, 3 and 4.

Referring first to the concrete slabs given on

Fig. No. 2, note that the 4-in. slab completely failed under 634 blows, the 6-in. failed under 1,329 blows, the 8-in. under 2,552 blows and the 10-in. did not fail after 6,000 blows, all of the slabs being on very poor subgrade. Theoretically, under a static load the strength of a beam varies as the square of the depth, but this fact does not furnish us any idea of how much resistance a slab will have when laid on a subgrade and subjected to impact. It is very evident, however, from the test results just given that the resistance of pavement slabs to impact varies very nearly as the square of the depth. Referring to the monolithic brick construction it seems that when subjected to impact this type of pavement apparently has about the same load supporting value as the corresponding thickness of concrete pavement. This fact is indicated by comparison of curves given in Figs. 3 and 4. It wil be noticed that the 4-in. concrete slab shows about the same resistance to impact as 4-in. wire-cut lug grouted brick on a 1-in. concrete base. The 6-in. concrete slab has about the same resistance as monolithic brick pavement on a 2-in. base; the 8-in. concrete slab, about the same as that of a 4-in. monolithic brick pavement on a 4-in. concrete base. It will be noticed that the deflection curve for the 10-in. concrete slab and the monolithic brick on the 6-in. base are quite similar.

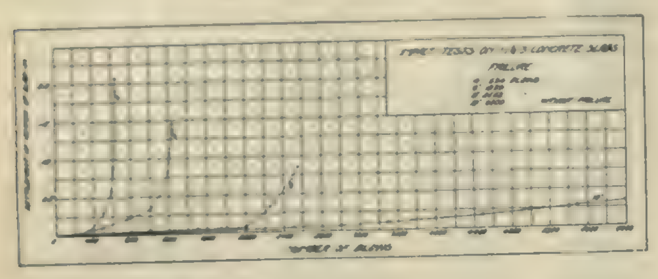

FIG. 2

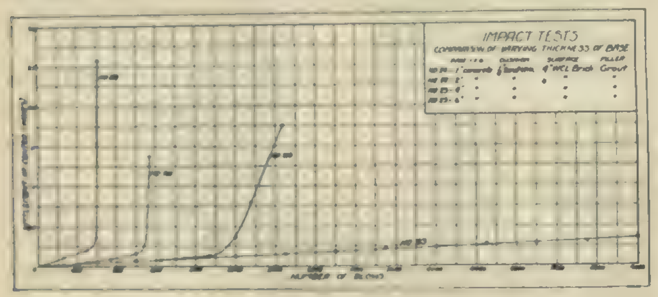

FIG. 3

Referring to Fig.4, there are shown four curves in which a comparison is made between the monolithic brick pavements in which two thicknesses of brick are used, 3-in. and 4-in. Comparing No. 20 with No. 22, pavements with 3-in. and 4-in. brick, respectively, but having the same total thickness of pavement, it is to be noted that the 4-in. brick shows somewhat higher resistance to initial failure than 3-in. brick, although the difference is hardly worth considering. Comparing No. 21 with No. 25, in both of which the concrete base is of the same thickness, but one containing 3-in. brick and the other 4-in. brick, note again that the 4-in. brick has the advantage. This might be expected in this case since the total thickness of the pavement is 8 in., as compared with 7 in. when the 3-in. is used. Referring to Fig. 5, there is shown a comparison of the resistance of brick pavement to impact when the fillers are varied. In the case of the asphalt filler, a 3½-in. vertical fibre brick was used, whereas with the grout filler a 4-in. wire-cut lug brick was used in the test section. In all cases except Curve No. 2, a 1-in. sand cushion was used under the brick. Note that comparing 6 with 5, 5 shows a somewhat higher resistance as it should since it has a 6-in. base. Comparing 11 with 12, there seems to be little difference in strength although one has a 6-in. base and the other a 4-in. base. There probably was a difference in the supporting value of the subgrade. No. 2, in which a tar-sand cushion and a tar-sand filler were used on the 4-in. base compares very favorably with 11 and 12. It should be noted that there seemed to be a slab action shown in the brick slab with the tar-sand filler. The brick adhered together very well, and several of the bricks were fractured, showing the efficiency of the bond. Note also that the section laid on a tar-sand cushion showed very much less deflection before failure than the other sections laid on a sand cushion. One characteristic about the curves for the test sections having sand filler is their large settlement before the initial failure takes place. When a pavement is built employing the sand cushion construction, there are two seperate slabs, the base and the wearing surface which can act independently of one another. Under impact the upper slab is not offered as much support directly under the load by the sand cushion, as in the case of monolithic or semi-monolithic construction. The upper slab, therefore,

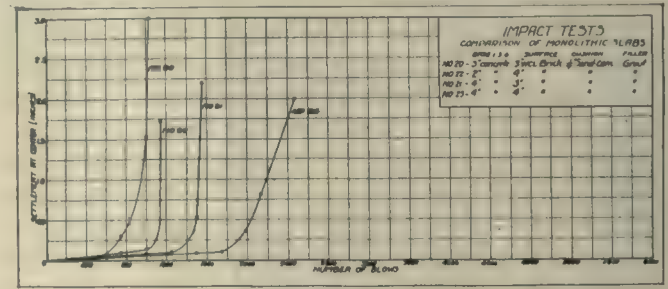

FIG. 4

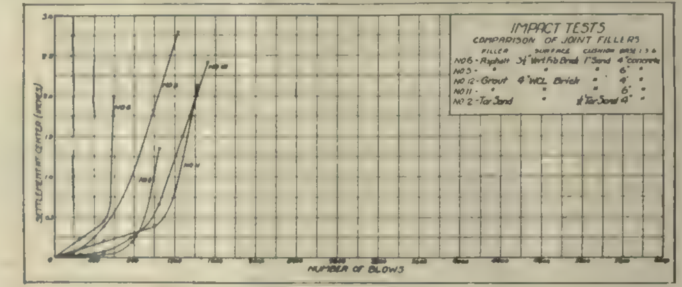

FIG. 5

fails first because of the excessive deflection and the base fails later. There is practically no horizontal shearing resistance offered in the sand-cushion construction along a plane where, in general, the maximum horizontal shear occurs, and very naturally the slab strength of sand-cushion construction is not as great as that of other types. Referring to Fig.6, a comparison is made of sand-cushion with semi-monolithic and monolithic types in which the same thickness of base is used in all three types. It is to be noted that these curves show resistance to impact following what one might predict from the slab strength of the different types. Thus, the monolithic type is stronger than the semi-monolithic, and the semi-monolithic is stronger than that of sand-cushion construction. Moreover, the 6-in. concrete base shows up stronger than the 4-in. concrete base in all cases.

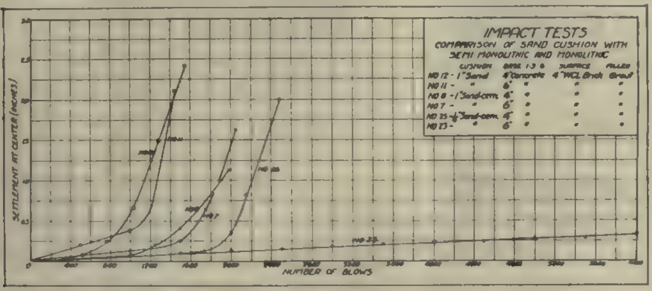

FIG. 6

In Fig. 7, there is a comparison of sand and cement-sand cushion construction, in which a vertical fibre brick has been used with an asphalt filler. With the 4-in. concrete base the sand-cushion construction seems to have somewhat more resistance than the sand-cement cushion construction, but the resistance of both types is exceedingly low. In the case of the 6-in. concrete base the sand-cement type shows up stronger than the sand-cushion type. It is to be noted here that the total thickness of the concrete base including the cement-sand cushion is 7 in., and that it is just a little stronger than the 6-in. concrete slab shown in Fig. 2. In Fig. 8, a comparison is made of brick surfacing laid on a macadam base with the same type laid on a concrete base. In fairness to the brick surfacing laid on a 6-in. macadam base, let it be said that this slab had cracked along the grouted joint before the test was started, and no doubt this accounts for the exceedingly low resistance to impact. When laid on 12-in. macadam, the 4-in. wire-cut lug brick, grouted, compares in its strength with that of a monolithic brick pavement having a concrete base between 1 and 2 in. in thickness. Again, in all fairness to these tests, let it not be forgotten that as soon as sufficient deflection is produced in the brick surface through compression of the base the surfacing will fail. A brick surface grouted on a macadam base is likely to show cracking quite readily since the macadam base probably is not of sufficient rigidity to prevent excessive deflection of the brick surfacing. It is probable that bituminous filler will give much more satisfactory results than a grout filler when a macadam base is employed. It is seen from the curves given in Fig. 8, that the macadam base does not offer the resistance to deflection under impact shown by the 4 and 6-in. concrete bases. The tests shown here were all made on a rather soft subgrade which was purposely kept wet by means of water in the side ditches. When the brick pavements supported on a macadam base failed, not only was the macadam compressed under the action of the load, but it was also punched down into the subgrade quite some distance.

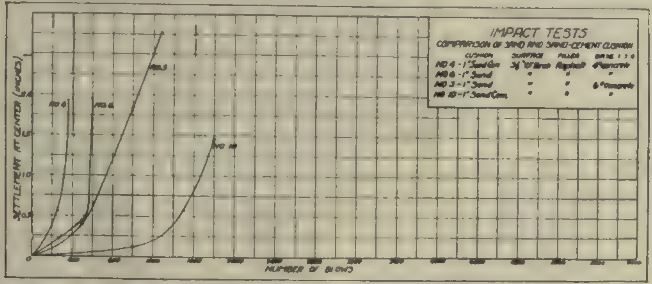

FIG. 7

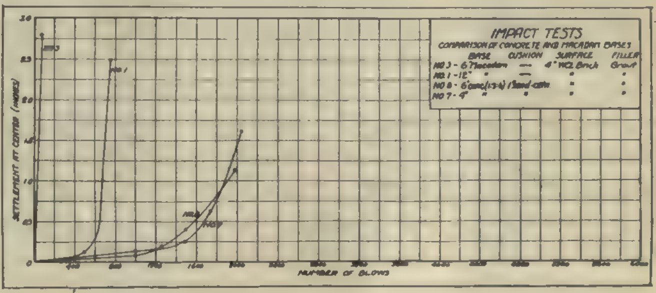

FIG. 8

It is always ill advised to draw definite conclusions from a set of tests made with only one specimen of each type and not under actual conditions existing in practice. The tests above described were made under conditions as nearly approaching those of actual practice as it was possible to make them, and the specimens were all tested under as nearly the same conditions as practicable. The curves do not show the actual service value of the different types of pavements under all subgrade conditions, but they probably do show very closely the load supporting value of the various types when laid on a soft subgrade. If the subgrade had been hard and non-yielding it should be perfectly evident that there would be less tendency for the surfacing to yield under heavy loads, and it should, therefore, be possible to decrease the thickness of the pavements without reducing the resistance below that indicated in the present tests. No doubt, when laid on a good subgrade some of the types which show up unfavorably in these tests would approach the more favorable types, because when the subgrade is of high

(Continued on page 344)

The Importance of Business Administration In Highway Affairs [*]

Importance of America's Highway Problem, the World's Greatest Construction Enterprise, Little Appreciated—Lack of Effort to Meet Situation—Continuity of Policy and Personnel, Divorce from Politics and Establishment of Road Building on a Business Basis Essential to Progress.

By A. R. HIRST[†]

Unfortunately, I do not possess the gift of anecdote of our friend Hines from Detroit. I wish with my whole soul that I did; and I also wish with my whole soul that he were going to make this speech. I'm not a humorist. No man that works for American states for 18 years can be a humorist. He has all the humor pounded out of him about the second year, and after the third or fourth year, Job is not a circumstance to him in patience and other virtues.

I'm going to speak seriously tonight because this American highway problem is now really serious. When Horatio Earle of Michigan and other pioneers first used to talk roads in this country, the American highway problem could be played with. It was really a joke because there was nothing but talk involved. But now that the American people propose to spend annually six or seven hundred million dollars in the construction of highways, it has gotten way beyond the point where, in peace times, even the American people can consider it a joke. In war times we learned to consider almost anything a joke that the politicians put over, but in peace times the temper of the American people is quite different, and they are going to expect from you and from me a final reckoning, at which time we will have to account for the talents that have been given us and the product that we have delivered.

I'm going to draw my text tonight from an advertisement of Marshall Field, Glore, Ward & Co. of Chicago, in the Chicago "Tribune" of today, advertising for sale an issue of $3,000,000 bonds of a corporation doing business in the great and good state of Wisconsin. The final line of this advertisement is: "The management is in the hands of the men who have successfully built up the business." That is my text: "The management is in the hands of the men who have successfully built up the business."

This shows that in the financial field—in the great field of the American dollar which after all regulates all American processes—one of the primary considerations in guaranteeing the security and safety of an investment is the character and longevity of service of the men who are going to spend the money and control the enterprise.

Despite the fact that the modern American highway business commenced in modern times in New Jersey about 1892—almost 30 years ago—there has not yet come into the minds of the American people the slightest conception of the fact that in this enterprise the commonwealths of America are really embarking upon a business enterprise of the very first magnitude. Some of the men who have been years in the game have not yet commenced to realize that this is true. Men who are promoting modern highways, or men who, like yourselves, are selling one of the most important products that enters into them, have seldom realized that here, stripped of its non-essentials and of its policies, is the largest construction enterprise in the history of the world.

We are wont to hark back to the time when America was being welded into a nation by the building of its railroads as the greatest exhibition of engineering and financial genius that the world has ever seen. But in the greatest five years of American railroad development—the years between 1879 and 1883, inclusive—there were built only 40,000 mi. of railroad, at an estimated cost of $800,000,000. In the next five years the American states and their under-commonwealths will build 100,000 mi. of road, costing at the very least $2,500,000,000. Even considering the dollar as being in 1880 worth twice its present worth, the amount of earth that will be moved, the materials that will be transported and placed, are more than twice as great as in the enterprise of building our American railroads, at its peak.

And what efforts are we making as a people to meet this situation? Practically none. It is a fact that in the legislatures just adjourning, for one American state that has made a step forward in the business management of its highway enterprise, there are two states which have stepped backward. The game that we used to play with the white chips only some ten or twelve years ago, a few hundred thousand dollars in a state or a few thousand dollars in a county, was beneath the notice of the politician or the grafter. But when a state has at its command fifty, eighty, or a hundred million dollars, it is worthy of the attention of a Tammany or of some of the other political machines which grow up under our eyes. Anything which has previously happened in the history of American experience with public work is going to be made to look like a game of pikers compared with what is going to happen in the United States of America with its highway money in the next decade unless you and the other business men of this country commence to realize that here at least is one public enterprise that must be divorced from politics and inefficiency.

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[*] Address before the Portland Cement Association, Chicago, Ill., May 18, 1921.

[†] State Highway Engineer of Wisconsin.

This highway business is just as much a business enterprise as is the conduct of any other construction or producing enterprise. You can't cut off the head or the body every time you happen not to like the color of the whiskers of the gentlemen conducting it and carry on an organization which will function at all.

Out of curiosity I got an old American Automobile Association "Blue Book" of 1913 and I checked over the executive officials of the state highway departments of America in 1913 as against those of 1921. The same management prevailed in just exactly five of the American states; and that is not eighty years—it is eight—of a construction enterprise.

I could probably talk a very long while without impressing you with the fact that this is a great enterprise. Each man, you know, boosts his own game. To the man who manufactures cement, the business of manufacturing cement is, naturally, the pre-eminent American enterprise. He shouldn't be in it unless it is that to him. I shouldn't be in the business of building highways unless it was, to me, the greatest of American enterprises. No man should engage in any work unless he is convinced that that work is of service, not only to himself but to the American commonwealth in which he happens to reside.

However, many of you gentlemen think of selling cement to a state or county merely as selling cement and when you have moved so many hundred thousands or so many million barrels you consider that your part of the enterprise is completed. I am not criticising the worth of your promoting organization, the Portland Cement Association. I have been in the highway business for eighteen years and as far as I know and have seen, it has carried on the cleanest, highest class propaganda for the promotion of a highway material that has been carried on in America. When we came back from Wayne County, Michigan, in 1911, after seeing what Ed. Hines had done there we were sold on concrete roads and we commenced to build them, and we have not yet stopped building them and I don't know when we will. You have been insistent on high class specifications for high class concrete roads. You have never let down an inch. You have insisted that we should go further than we, as engineers, sometimes believed to be necessary. But by and large, you were right.

There is just one more thing which I believe you should add to your chain and that in my impression is the most important one, and that is to join this propaganda, if you call it so, for the creation of a proper spirit in the minds of the American people so that they will build up adequate highway organizations to spend the millions they have made available for highway construction. You think, or at least you say you think, that concrete structures, concrete roads, concrete bridges, concrete culverts, are the economical type in a very large number of cases and that given an honest and experienced highway department, they will sell themselves on their merits as a business and economic proposition. I won't debate that with you because I believe that they will. From your own selfish standpoint, if the production of concrete roads and concrete structures is to proceed, if they are the proper kind of structures for a county or a state to invest its money in, your only safety in advancing your interest is to help counties and states to secure and keep absolutely honest and experienced highway departments, because when you have those you have nothing to fear if your product and methods are right. It is only the man who sells a product which is not right or of which he is ashamed that could want inefficient or crooked executives in control of highway expenditures.

The bare engineering work in the construction of a few hundred roads and bridges is more or less routine. A state with a proper organization can turn out a hundred miles of concrete road or a thousand, given the money, just about as prolifically as rabbits are turned out and cast just about in the same mold, the one with the other. But the thing that you must guard against, if you are going to build up a consistent business in highway materials, is the lack of continuity of this performance. This thing of a state being prolific one year and using a couple of million barrels of cement and having an attack of cold feet the second year and using a couple of thousand does not make for normal or consistent business or progress. So long as every politician who happens to be elected to any place sets himself up instantly as a highway arbiter to whom every "i" and "t" must be submitted, and he must see that they are dotted and crossed, and he won't play at all unless the game is played just as he imagines it should be played, throws monkey wrenches into the machinery—which does not make for consistent progress in our American highway programs.

The people of Wisconsin have spent something like $60,000 in my education in the highway business in the 14 years I have been with them—and a good many of the good people of the state think that is an awful investment for the result—but that education, that close observance of the building up of American traffic and of the building up of American highways, at least so far as Wisconsin is concerned, has convinced me that so long as prices are fair, so long as there is no extortion, so long as everybody concerned in producing these roads is getting only a fair profit, we can't pay too much for them. Because, no matter how fast we may go, there is no American state that can produce the highway system which it ought to have as soon as it ought to have it, and we can't see one year or two years or three years drop out a dead loss in our program of highway improvement. So we in Wisconsin are paying the price. We are building them as cheaply as we can, but we are paying almost as much for concrete roads this year as we did last year and we are building three times as many miles this year as we did last year and twice as many as we did in any year of our history, because our people need the employment and because we have become convinced that no matter how fast we can mechanically proceed, we can never produce the roads as fast as we actually need them in order to properly carry on the state's business.

We are not only building these few miles of concrete roads, but we are also building something like 2,000 mi. of other types of road, simply because we can't furnish the money or the mechanical equipment to build concrete roads fast enough to accommodate the traffic of the state. The trouble with many states is that they vote bond issues of so many millions, or they produce so much money by taxation, and men who have had no experience with the game figure that any time they turn on the faucet the roads will run out and in about six months the state will be roaded from end to end. There is no American state—I don't care how many millions or hundreds of millions it will produce—there is no American state which can road itself within ten years if its starts now at full speed. And when at the end of ten or fifteen years it thinks it has roaded itself, it will be ready to start doing it over again, probably, or doing more of it. There is no finish to this proposition.

I remember that when we passed a state aid law in 1911 one of our good Wisconsin counties was opposed to it. Its representatives voted against it because they said that this county had finished building its roads and it didn't want to help anybody else build theirs. Last year, just nine years later, that good county bonded itself for $2,000,000 to build concrete roads. So it hasn't yet finished. I hate to tell them so but they never will finish.

I want to go over some of the little items in this program of ours this year to show you that it isn't just a plaything. It is really quite a job that the average state highway department goes up against. We will grade about 2,200 mi. and doing that we will move about 8,000,000 yd. of earth. We will build approximately 8,000 concrete culverts. The aggregate length of these if placed end to end would be 40 mi.

We are building 600 bridges. The total length of these will be in excess of 4 mi.

We expect to build 280 mi. of concrete roads. This will involve the use of 980,000 bbl. of cement or 4,300 average carloads, and 1,344,000 tons of sand, gravel and stone, which would make 26,880 carloads of sand, gravel and stone. Besides this little enterprise, we are building 1,000 mi of gravel road involving the preparation and hauling of 1,500,000 cu. yd. of prepared gravel. In addition to this construction work, we are maintaining 7,500 mi. of the state highway system at a cost of about $2,000,000, employing 900 patrolmen; and our counties are maintaining 5,000 mi. of road, employing 600 additional patrolmen. In all, there will be engaged in this work in Wisconsin approximately 25,000 men. So that if it were all overturned in a night, and a set of politicians put in to run the game to see what advantage they might get out of it for their party or faction, it would really be a rather serious thing for the people of Wisconsin.

I'm not taking to myself any great amount of credit for the fact that for 14 years Wisconsin has operated a non-political, business-like highway enterprise. No one man, no single set of men, could bring about the kind of results we have had in Wisconsin, so far as the non-political control of this work is concerned, unless the spirit of the people of the state itself were right. And whatever may be said of Wisconsin as to the idiosyncrasies of its people or of its climate, the ground in Wisconsin has been peculiarly ripe for the development of a clean cut business highway enterprise. Neither I nor any other man can produce the soil for such development in any state unless the people of the state are first educated to appreciate the importance of such an attitude toward their public work. You can't bring it in by one man, you can't bring it in by a single highway commission. It is a process of education, slow possibly, but the educating can be done if the state's leaders are clean and right, as Wisconsin's have been.

The fact must be pressed in upon the American people that if they are going to get anywhere near the shadow of a dollar for every dollar they are so willing to spend in highway work, they must divorce that work from the average run of state and county business and put it on an absolutely sane and efficient basis. The men who work in the state highway departments are neither politicians nor grafters. Nine out of ten of them are graduates of high class colleges and universities—most of them civil engineers. A right highway department, be it state or

(Continued on page 344)

GOOD ROADS

CONSTRUCTION TRANSPORTATION MAINTENANCE

Founded January, 1892

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LICENSING AND TAXING MOTOR VEHICLES

Additional taxes on automobiles are being vigorously opposed by the National Automobile Chamber of Commerce, one of the arguments put forward in opposition to levying more heavily upon motor cars being that the automobile has ceased to be a luxury for the wealthy and has become a utility for all.

Even a superficial knowledge of the distribution of motor cars bears out the truth of that contention. And the very fact that there are so many automobiles in use is a vital reason why there should be a sweeping reform in the methods of licensing and taxing motor vehicles.

There will always be many different opinions on the question, but there are certain points upon which there should be a reasonable degree of agreement.

For instance, there is an obvious need for uniformity in laws relating to the registration, licensing and regulation of passenger cars and trucks. This at least suggests federal rather than state control.

There is also the desirability of establishing a better basis of taxation—one that will take into account certain governing factors, now neglected, that will distribute the burden more equitably.

These and many other matters migh well be taken up by the automotive interests with the active cooperation of road officials and engineers.

BUSINESS METHODS AN URGENT NEED OF COUNTRY'S CHIEF BUSINESS

"The largest construction enterprise in the history of the world," as the road building program of America was characterized by State Highway Engineer Hirst of Wisconsin in a recent address before the Portland Cement Association, is not appreciated at its true value, even by the men who have been connected with it the longest, he believes, nor is any real effort being made to handle the situation as it should be handled.

Furthermore, Mr. Hirst contends that "anything which has previously happened in the history of American experience with public work is going to be made to look like a game of pikers compared with what is going to happen in the United States of America with its highway money in the next decade," unless the public awakens to the fact that highway work "must be divorced from politics and inefficiency."

The underlying causes of waste and lost motion in the administration of American highway work are: Politics; lack of continuity of policy—which is largely, though not wholly, the result of political interference; and inadequate remuneration of those responsible for the conduct of the work. All of these are matters to which frequent references have been made in this column and to which Mr. Hirst referred in no uncertain terms in the course of his address.

Among the pernicious results of political meddling with highway work are the constant changes in personnel of state and other highway departments. According to Mr. Hirst, for instance, the highway affairs of only five of the states are under the same management now as they were in 1913—only eight years ago.

The lack of continuity of policy, which, of course, is to a great extent the result of changing personnel, can not fail to retard the general progress of road work. The effect it has upon the contracting business, particularly in regard to the fluctuation in the volume of work from year to year, was explained in a paper by a leading contractor, W. A. Rogers, printed in the issue of June 15. It is also demoralizing in its effects upon the morale of a highway department and a hindrance to safe and sane financing.

Inadequate salaries have prevented the retention of trained men in the services in which they have gained their experience. The loss of such men means the loss of an investment yielding an exceptionally high return. Engineers who have acquired skill and experience in state highway departments are constantly leaving to take positions in private undertakings where their services are appraised at more nearly their real value.

"Three out of four of the executive officials of the state highway departments of America get $5,000 or less per year," Mr. Hirst said. "Is it any wonder that they are not world beaters or record breakers? It is not. The only wonder is that so many good men are still in the business."

Bringing to the attention of every taxpayer a brief and forceful resume of Mr. Hirst's address would be a good first step in one of the campaigns of popular education in respect to road matters that are occasionally advocated by enthusiastic "road boosters." It contains about all that the general public needs to know about the subject.

Bennett Sued by Motorist

A suit for $700 has been field by Thomas Lacy of New Britain, Conn., against C. J. Bennett, State Highway Commissioner. Lacy ran his automobile last year into a pile of crushed stone on a state road under construction and the vehicle overturned, injuring him.

"The Nevada Highway News"

State Highway Department Commences Publication of Bi-Weekly Report of Its Work

The State Highway Department of Nevada has commenced the publication of a bi-weekly report of its activities, the first number being dated June 11.

It is an 8½x11-in. book and is issued, according to an introductory statement by State Highway Engineer C. C. Cottrell, "to meet an obligation of keeping our public fully informed and to avoid the bad consequences of not doing that."

The first number contains Mr. Cottrell's explanatory introduction, an article on "The Graduated Scale of Federal Highway Aid for the Public-Land States," and a number of items of general news.

Tree Planting in Pennsylvania

State Highway Department Plans to Beautify All Main Routes

During the past few weeks the Pennsylvania State Highway Department has planted a large number of American elms and sugar maples along the state highway between Harrisburg and Gettysburg.

"It is our aim eventually," said State Highway Commissioner Sadler, "to beautify the main highway routes in Pennsylvania through the intelligent planting of shade trees."

A tentative plan has been worked out by the Forestry Department whereby a comprehensive system of planting trees along state highway routes will be taken up. The Commissioner of Forestry will make a survey of the planting site and recommend the species to be planted, giving in detail the methods to produce the best results. The trees will be furnished from the state nursery as fast as they become available.

New York Road Bonds on Sale

The National City Co. of New York, N. Y., is selling $20,000,000 of 5% New York State road bonds at prices from 99.85 and accrued interest for bonds of short maturity to 105.75 and accrued interest for bonds of long maturity. The yields at these prices range from 5¼% to 4.7%.

New Jersey County Spends $21,000 in Attempt to Oust Engineer

Services of lawyers and witnesses at the trial of F. A. Reimer, former County Engineer of Essex County, New Jersey, for neglect of duty, cost the county $21,000. Reimer has appealed from the adverse decision of the lower court. Fredrick Caldwell, who was employed by the county at $500 per month, presented a bill for $1,600 for services at the trial, in addition to his salary.

Governor McKelvie of Nebraska Raps Townsend Bill

Says Measure Would Disrupt Present Course of Highway Development For Extravagant Fancy

Adding to the long list of prominent men opposed to the passage of the Townsend Bill, Governor S. R McKelvie of Nebraska has written a vigorous letter of protest against the measure to Nebraska's senators and representatives in Congress.

"The proposal to appropriate $100,000,000 for the building of an interestate system of public roads undoubtedly would mean the discontinuance of federal aid for the general construction of the roads in the states and would result in the construction of a very few primary highways that would serve a relatively small percentage of people," said Governor McKelvie.

Continuing, the governor brands the proposed high salaried commission as a "policy of administration that has been thoroughly discredited." He declares that the Department of Agriculture is handling this work capably and suggests that for the present it be continued with that department. In speaking of the success of the present plan of road construction the governor says:

"The State of Nebraska is developing a system of 5,000 mi. of earth roads at the minimum of cost. These roads serve directly 65% of the people of Nebraska, who live immediately adjacent to them, while 75% of the travel is either directly on these roads or originates within 1 mi. from them.

"To abandon the present program in support of the present Townsend Bill would be uneconomical and extravagant in the extreme."

The Nebraska Department of Public Works, the Nebraska Good Roads Association and other state organizations, it is reported, are backing the governor in his stand against the Townsend Bill.

Recommends Higher Interest Rate for New Jersey Bridge Bonds

Because of the recent failure to sell $5,000,000 worth of New Jersey bridge and tunnel bonds, T. A. Adams, chairman of the Interstate Bridge and Tunnel Commission, has recommedned that the interest rate be increased from 5 to 5½%.

Dowell and Townsend Bills Before Congress

The Townsend Bill, amended to reduce the number of commissioners to three with salaries at $5,000 per year, will be taken up by the Senate after disposition of some of the important bills now before it. The bill was also amended to eliminate the 66-ft. right of way and 20-ft. wearing surface provisions, leaving these matters to the discretion of the commission.

The Dowell Bill, now before the House as a rider on the Phipps Bill, has been amended so that 50% of the appropriation for forest roads is to be spent on main interstate roads.

Increased Motor Taxation Opposed

Witness Tells Senate Finance Committee That Federal Taxes on Automobiles are Taxes on Agriculture and Commerce of Country

The National Automobile Chamber of Commerce is vigorously opposing the recent proposal of the Secretary of the Treasury that additional taxes be levied on automobiles. George M. Graham, Vice President of the Pierce-Arrow Motor Car Co. and a director of the National Automobile Chamber of Commerce, recently appeared before the Senate Finance Committee in Washington, D. C., and pointed out that the automotive industry is already bearing a sales tax higher in percentage than contemplated in any of the suggestions offered. The federal tax amounts to 5% on passenger cars, 3% on trucks and 5% on repair parts for both.

The total raised in federal taxes for the current fiscal year amounted to $149,000,000. In addition there were state taxes of $107,000,000 and municipal taxes of $11,000,000, making a total of $267,000,000.

"Apologists for this tax," said Mr. Graham, "may argue that it is a tax on wealth. There are ample facts to disprove this contention. Approximately one-third of the automobiles in use in the United States have been purchased by farmers. There is a car in use on one of every two of the 6,300,000 farms in the country.

"Of the 9,000,000 automobiles in the United States, 6,000,000 have been purchased into homes whose total income is $4,000 a year or less. It is a fallacy to refer to the passenger automobile as a pleasure vehicle. It is actually a medium of individual transportation. A careful survey shows that 90% of all passenger cars are at some time used for business purposes and that 60% of the passenger car mileage is utilitarian.

"In the United States 26,000,000 food producers are trying to feed themselves, 79,000,000 additional Americans and many Europeans. It is an enormous task, made harder by waste from inadequate distribution. Over American highways passes a volume of food products of astounding dimensions.

"Agricultural crops, dairy products, poultry, produce and domestic animal production reached an aggregate of more than $21,000,000,000 in 1920. Of this volume, motor trucks carried a substantial part.

"Not only is food transportation stimulated by highway transportation from the farms, but mention should be made of the help rendered by motor trucks to plants which preserve, produce, refine, retail and store various foods products."

Pennsylvania Will Not Eliminate Grade Crossings

Governor Sproul of Pennsylvania has vetoed the bill passed at the recent session of the Legislature which provided for the elimination of 2% of the grading crossings on main lines annually. In vetoing the measure, Governor Sproul said that while the plan was commendable, it was impracticable, as it would cost some of the railroads several million dollars a year.

File Report on Delaware Bridge

The Board of Engineers of the Delaware River Joint Bridge Commission, appointed by Pennsylvania and New Jersey for the construction of a bridge between Philadelphia and Camden, has filed its report with the commission. The report recommends that the bridge be of two-cable, double-deck suspension type with a span 1,750 ft. long, providing for 6 lines of vehicular traffic, 4 lines of rail traffic and two 10-ft. sidewalks, and with a total width of 125.6 ft. The total estimated cost of this bridge is $28,871,000. The structure will take four or five years to complete.

Brands Testimony of Townsend Witness as False

State Highway Commissioner Coleman of Virginia has made a flat denial of the testimony of W. H. Rickard, Jr., of Natural Bridge, Va., who testified at the hearings on the Townsend Bill that the Virginia State Highway Commission manipulated a road route for the benefit of one of its members. Mr. Coleman points out the fact that the General Assembly in 1918 laid out the route and that James Munday, who owns a hotel on the route, was not a member of the commission at that time. Rickard described himself to the committee as a farmer, railroad promoter and builder.

Highway Researches and Their Results

(Continued from page 337)

supporting values less stress will be created in the slab, since it would then deflect less under the load. We should remember, however, that in the design of our roads we are concerned most with their design to withstand unfavorable conditions, and the most unfavorable condition arises when the subgrade is soft.

The results given above would be incomplete without some mention of the character and supporting value of the subgrade. Whenever a slab was broken tests were made of the bearing value of the subgrade, by means of a small impact machine.

This device consists of nothing more than a steel weight or plunger weighing 10 lb, having an area of 10 sq. in. Guided by means of a rod, a 10-lb. weight is allowed to fall from a definite height upon this plunger, and the penetration is noted after a definite number of blows. This is purely an arbitrary method for determining the relative bearing value of the soil and furnishes a convenient field method for testing the soil. Moisture samples were also taken to determine the amount of moisture in the soil. At present we can not make use of those results for rational design. They serve, though, to aid our judgment and form one step more toward our final solution.

WEARING MACHINE USED BY BUREAU OF PUBLIC ROADS TO TEST PAVEMENTS.

Distribution of Pressures to the Subgrade

There is one other investigation I should like to mention briefly, because I feel that future investigations of this kind are apt to have an important influence on road design, particularly roads of the non-rigid type. I refer to an investigation made to determine how heavy wheel loads are transmitted to the subgrade, and what intensity of pressure is to be expected under such loads. Some few years ago, some soil pressure cells were developed in the Bureau of Public Roads and were placed under the Camp Humphrey's concrete road. Investigations were made by means of these cells to ascertain the intensity of pressure under the 8,500-lb. wheel load of a heavily loaded Class B Army truck. Recently a similar test was made with a 5-ton truck having the same load carrying capacity and loaded with a higher gross load in the rear than in the case of the Class B army truck. The load, however, instead of being carried on the two rear wheels was carried on four rear wheels, and the two curves of pressure distribution under these respective wheels are shown in Fig. 9. Now an 8-in. concrete road has considerable slab strength and it, therefore, effects a considerable distribution of the concentrated load to the subgrade. Notwithstanding this distribution, however, the highest intensity of pressure registered under a wheel is somewhat higher than certain subgrades are apparently able to bear when they become water-soaked. The significance of such an investigation should be apparent. It is plain that if we are to avoid undue settlement of our roads we must design them so that the highest intensity of pressure transmitted to the subgrade will not exceed the bearing value of the soil. By distributing the gross load over more wheels the intensity of pressure on the subgrade is decreased, and this should result in less settlement of the subgrade and consequently less distortion of the road surface. When the bearing value of a poor subgrade is known it would seem that an investigation of the distribution of pressures through road surfaces of different types and thicknesses should finally lead us to the knowledge as to what thickness of road surface is required to so distribute the pressure that its intensity on the subgrade will be kept within reasonable points. A series of tests will shortly be conducted along this line involving a large number of different kinds of slabs both of the rigid and non-rigid types.

(To be continued)

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The Importance of Business Administration in Highway Affairs

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county, has a personnel of clean-cut, well educated Americans who are neither crooked nor inefficient and who do not intend to become so; and if you are going to get and retain that kind of men in highway work, you must establish conditions in the business that are just as clean cut and just as attractive as they are in any other kind of business. These conditions are almost nowhere prevalent in the American states. You insist in all your promotion work upon efficiency in highway construction. Did you ever think that in the executive offices of the average American state there was no salary ever heard of above $5,000 a year? Most of the governors of the states get that or less. Three out of four of the executive officials of the state highway departments of America get $5,000 or less per year. Is it any wonder that they are not world beaters or record breakers? It is not. The only wonder is that so many good men are still in the business. It is lovely and refreshing to work for honor in a state and have every taxpayer envy each mouthful you eat; wonder, when you smoke a cigar that cost over two for a nickel, why the state pays you so much. But, gentlemen, after you have been at that, as I have, for 18 years, it really commences to pall a little upon you, and you come to the stage I have reached where you determine that you will retire to private life, buy some quiet farm somewhere, put in two nice fancy gate posts there and on those gate posts print a sign like this: "This is the residence of so and so, Citizen and Taxpayer. You may all go plumb to Hell."

You must make this business of building highways attractive for the best there is, or you are going to get the worst there is. You can't sit quietly here and say: "Politicians are rotten; all political offices are necessarily filled by the incompetent or the crooked," and let the world roll on. You can't do it because, if you do that, within the next ten years the world will roll on, but it will roll on you and your business.

I'm coming back once more to the point that I made a minute ago—that if you are going to have a worthy product that will sell itself to the well informed, your only salvation is getting efficiency in highway organizations. If you have an unworthy product which will sell itself to the uninformed or those with itchy palms, then you don't want efficiency in highway departments. Promote the other kind of department.

The curse of the American people is that they think last instead of first. Bond issues have been promoted in states and counties until there has been rolled up a most tremendous sum of money—more than was ever before collected, except for war purposes—and after it has been rolled up and made available, about four out of five of the legislatures are still debating as to what they are going to do with it and it is lying in the banks, or potentially available, while the people who paid it in or who have made it available are still traveling on the kinds of roads that they had ten years ago—yes, worse than that, because the roads have not stood still if the states have.

When I went into Wisconsin in 1907 there were registered 3,000 motor vehicles. This year, we will register at least 350,000 and we are pikers compared to Illinois or Indiana or Michigan or Ohio or New York or Pennsylvania. Those 350,000 vehicles will travel at least 1,000,000,000 mi. over Wisconsin highways. They create a traffic problem greater than any traffic problem created on any American railroad system. It isn's a question of debating whether we shall pay $30,000 or $32,000 or $37,000 per mile for some of the essential links of our trunk highway system. We must get this traffic through, and an expenditure of a few thousand dollars more or less on a necessary link is not even a marker to the expenditure that has dropped into the mud holes on uncompleted portions of some of the main highways of every American state. There is a mud hole on the principal highway between Chicago and Wilwaukee—the only mud hole in an otherwise good highway for almost 100 mi.—remaining unimproved because of lack of local or state action that causes a loss in religion alone of probably $50,000 per year.

One last thought: If we can send you home to your respective states wherever they may be, North, South, East or West, with a little different idea of this game than you came here with, we will have been well repaid. Your business in the next few years, in my opinion, is not only to promote the use of cement in concrete roads and bridges, but over and above that to promote in the minds of the American people the idea that they must divorce this one thing from politics, religion and favor. Let them have all the other state and county offices, play politics with all the county clerks and the auditors and the coroners. If you will, let them play with them, pull their hair out by the roots, have them dye their hair when it's green and they want it blue, but make them understand, if you can, that while America is rich, rich beyond the dreams of avarice, it is not rich enough—now that hundreds of millions of dollars are to be spent in highways—it is not rich enough to play the highway game as it has played it the last ten years. America must wake up, turn over and start again with the one idea that this is the greatest business enterprise that the American people have ever undertaken and that it must be made a clean cut and efficient operation.

Committee May Study Florida's Highway Needs

The Florida Senate has passed a resolution providing for the appointment of a legislative committee on roads, to report at the next session in 1923. The committee will make a study of the laws of other states, will investigate the methods of highway development in Florida and will make recommenadtions for future road legislation.

Ohio Law Limits Vehicle Loads

On June 7 Governor Davis of Ohio signed the Burke Bill, which regulates the use of motor vehicles on public highways by limiting the weight of loads to 650 lbs. per inch of tire width. The total weight of motor truck and load is limited to 20,000 lb. Previously, the maximum total weigth of truck and load was 24,000 lb., and automotive interests greatly opposed any reduction in maximum permissible weight.

MEETINGS

Calendar of Coming Meetings

June 28-July 1—Society for the Promotion of Engineering Education—Annual convention, New Haven, Conn. Secretary F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Aug. 30-Sept. 1—Michigan State Good Roads Association.—Annual meeting, Flint, Mich. P. T. Colgrove, Pres., Hastings, Mich.

Oct. 24-28—American Society for Municipal Improvements—Annual Convention, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Society for the Promotion of Engineering Education

The annual meeting of the Society for the promotion of Engineering Education will be held at New Haven, Conn., June 28 to July 1. Discussion will be held on three general topics, viz., the curriculum, the faculty and the student. President Hadley of Yale will make the opening address; W. H. Burr, of Columbia University, will speak on "General Studies in the Engineering Curriculum;" Dr. W. F. M. Gross will speak on, "Engineering Teaching and Practice;" J. W. Hallock, of the University of Pittsburg, on, "Some Results of the Cooperative System

The Rochester (N. Y.) Engineering Society held its annual meeting on June 10 and elected the following officers: President, Harold O. Stewart; First Vice President, Charles C. Evans; Second Vic President, Waldo G. Wildes; Secretary, G. P. Havenor; Treasurer, Louis J. Summerhays.

PERSONAL MENTION

T. M. Brewer has been appointed city engineer of Viroqua, Wis.

E. C. Dollard has resigned as city engineer of Jamestown, N. Y.

August E. Kringel has been appointed city engineer of Green Bay, Wis.

W. W. Reed, formerly City Engineer of Green Bay, Wis., has entered private practice in that city.

Harold B. Wood has been placed in charge of the New York office of the Jeffrey Mfg. Co., of Columbus, Ohio.

I. N. Lamb has been appointed professor of civil engineering at McGill University, Montreal, Canada.

F. M. Clark, formerly with the Barrett Co. in Canada, is now construction engineer with the Maine State Highway Department.

John Horridge has been appointed supervising engineer in the Division of Street Cleaning of the Department of Public Works, Philadelphia, Pa.

Dr. Ernest F. Nichols, formerly President of Dartmouth College, was inaugurated president of Massachusetts Institute of Technology on June 8.

PUBLICATIONS

PORTLAND, ME. COMMISSIONER OF PUBLIC WORKS. Report for the year of 1920. Paper, 6x9 in., 117 pages and covers; illustrated.

This report covers the activities of the Portland Department of Public Works for the calendar year of 1920, including street work. It contains a large amount of tabular statistics, as well as a detailed account of the department's operations. Considerable space is given to a discussion of snow removal by the street railway company.

HIGHWAY ENGINEERING: RURAL ROADS AND PAVEMENTS. By George R. Chatburn, A.M., C.E., Professor of Applied Mechanics and Machine Design and Lecturer on Highway Engineering, University of Nebraska. (The Wiley Agricultural Engineering Series, Prof. J. Brownlee Davidson, Editor). Cloth 5¼x8 in., 379 pages, illustrated. John Wiley & Sons, Inc., 432 Fourth Ave., New York, N. Y. $3.00.

This book is a new text on highway engineering, dealing especially with rural road work. According to the author's preface: "While technical analyses and technical language have not been shunned, it has been constantly borne in mind that the book is intended primarily to form one of a series in agricultural education. It is believed, therefore, that the work is of such a character that it will be read with interest by the layman and, because here are brought together many ideas from many sources, will serve as a useful reference book for professional engineers, road builders, and road officers." The chapters, following a few pages of introductory matter on the economic phases of highway improvement, are as follows: Road Location; Types and Adaptation of Roads; Drainage; Culverts and Bridges; Earth Roads; Sand-Clay Roads; Gravel Roads; Broken Stone Roads; Pavement Foundations; Brick, Stone, Wood and Other Block Roads; Concrete Roads; Bituminous Roads; Surface Treatment to Mitigate and Prevent Dust; Revenue Administration and Organization; Miscellaneous. The book is illustrated by 186 figures comprising reproductions of photographs and drawings.

CONTRACT NEWS

CONTRACTS PENDING—REPORTED IN PREVIOUS ISSUES

Date of Letting		See GOOD ROADS Issue of
	ROADS AND STREETS	
6-29	Quebec, Que. W. B. Macadam	6-15
7- 6	Dade City, Fla. Grading and paving	6-22
6-29	Manchester, Ia. Grading and draining	6-22
7- 6	Hiawatha, Kan. Paving streets.	6-22
7- 6	Belvidere, N. J. Concrete paving	6-22
7-11	National City, N. J. Concrete pavement	6-22
7- 5	Plainfield, N. J. Bituminous concrete	6-22
6-29	Trenton, N. J. Gravel road	6-22
6-30	Woodbury, N. J. Amesite paving	6-22
7- 6	Washington, N. C. Grading and surfacing	6-22
6-30	Williamsport, Pa. Concrete curbs	6-22
7- 2	Spaulding, Neb. Paving	6-22
6-29	Wayne, Neb. Brick paving	6-22
7- 1	Erwin, Tenn. Paving	6-22
7- 1	Bastrop, Tex. Grading and surfacing with gravel	6-22
6-30	Ft. Worth, Tex. Bituminous concrete surfacing	6-22
6-29	Hondo, Tex. Gravel surfacing	6-22
	BRIDGES	
6-30	Bethlehem, Pa. Bridge	6- 8
7- 6	Santa Fe, New Mex. Bridges	6-15
7- 1	Troy, N. Y. Bridge	6-15
7- 5	Flint, Mich. Rein. concrete Bridge	6-22
7- 8	Wisconsin Falls, Wis. Rein. concrete bridge	6-22

Items preceded by * **are noted for the first time and are not included in above table.**

ROADS AND STREETS

Bids Asked for and Prospective Work

***Montgomery, Ala.**—Bids will be received by State Highway Comn. until July 6 for grading, draining and surfacing with bituminous macadam 3.48 mi. of road in Rallaposса Co., involving 24,930 cu. yd. excavation, 6 acres clearing, 3,097 cu. yd. rock excavation, 11,580 sta. yd. overhaul, 57 cu. yd. concrete, 16,340 sq. yd. bituminous macadam paving.

Bids will be received until July 26 by State Highway Comn. for grading, draining and surfacing with gravel 10 mi. of road in Walter Co., involving 13 acres clearing and grubbing, 42,771 cu. yd. common, 8,149 cu. yd. borrow and 13,475 cu. yd. rock excavation, 383 cu. yd. concrete, 14,643 lb. reinforcing steel, 23,460 cu. yd. gravel. Address W. S. Keller, State Highway Engr.

Little Rock, Ark.—City plans to surface 26 blocks with concrete. Thirteenth St. will be paved between Main and Sycamore Sts. Address City Engr.

***El Monte, Cal.**—Bids will be received until July 7 for paving streets, involving 32,060 sq. ft. 6 in. concrete and 129,908 sq. ft. 5 in. concrete. Address City Engr.

***Longmont, Cal.**—Bids will be received until July 5 by city for 33,500 sq. yd. 6 in. concrete paving, 6,800 lin. ft. Concrete curbing and 9,500 cu. yd. excavation. Address George H. Stenex, City Clk.

***Sacramento, Cal.**—Bids will be received until July 5 by State Highway Comn. for paving with bituminous macadam 8.3 mi. of road in Inyo Co. and grading 11.7 mi. of road in same county. Address A. B. Fletcher, State Highway Engr.

Denver, Colo.—City plans to pave a number of streets with asphalt and concrete. Address J. B. Hunter, Engr.

Hartford, Conn.—City plans to widen High St., estimate $25,000. Address R. N. Clark, City Engr.

Apopka, Fla.—City has voted $50,000 for street improvements. Address mayor

***Kissimee, Fla.**—Bids will be received by the Bd. of Co. Comrs. of Oscela Co. until July 11 for the construction of 10 mi. of hard surfaced road. Address J. L. Overstreet, Clk.

***Decatur, Ga.**—Bids will be received until June 30 by DeKalb Co. for constructing 7.45 mi. of road, involving 543 cu. yd. concrete, 81,235 sta. cu. yd. overhaul, 47,698 cu. yd. earth and 7,537 cu. yd. rock excavation. Address J. W. Hawkins, Co. Engr., Atlanta.

***Burlington, Ia.**—Bids will be received until June 30 for paving Main St. between South St. and Harrison Ave., with asphalt or brick on 8 in. concrete base, estimate $65,000. Address H. A. Vollmer, City Engr.

***Carbondale, Ill.**—Bids will be received until July 12 by city for paving various streets with brick on concrete base, estimate $127,000. Address E. A. Fox, Engr.

***Palestine, Ill.**—Bids will be received until July 15 by city for paving 30 blocks of streets with brick on concrete base, estimate $100,000. Address E. F. Mail, Engr.

***English, Ind.**—Bids will be received until July 5 by the Bd. of Comrs. of English Co. for grading, draining and paving with stone 12,187 ft. of highway.

Bids will be received until July 5 by the Bd. of Comrs. of Crawford Co. for grading, paving and surfacing 4,820 ft. of road in Liberty Twp. Address A. N. Bobbitt, Co. Aud.

***Franklin, Ind.**—Bids will be received until July 4 by the Bd. of Comrs. of Johnson Co. for grading, draining and paving with concrete 2,635 ft. of road in Hensley Twp.; estimate $19,100.

Bids will be received until July 4 by the Bd. of Comrs. of Franklin Co. for grading, draining and paving with concrete 3,669 ft. of road in Pleasant Twp.; estimate $24,013. Address John C. Gregg, Co. Aud.

***Jasper, Ind.**—Bids will be received until July 4 by the Bd. of Comrs. of Dubois Co. for grading, draining and paving with crushed stone and gravel 5 roads in Hall Twp. Address Frank J. Seng, Co. Aud.

***Kokomo, Ind.**—Bids will be received until July 6 by the Bd. of Comrs. of Howard Co. for grading, draining and paving with stone 15,840 ft. of highway. Address Orville O. Butcher, Co. Aud.

***Madison, Ind.**—Bids will be received until July 6 by the Bd. of Comrs. of Jefferson Co. for grading, draining and surfacing 5,280 ft. of road in Smyrna Twp. Address Charles S. Dibler, Co. Aud.

***Princeton, Ind.**—Bids will be received until July 6 by the Bd. of Comrs. of Gibson Co. for the grading, draining and surfacing with rock or gravel 11,700 ft. of road in Washington Twp.

Bids will be received until July 6 by the Bd. of Comrs. of Gibson Co. for grading. draining and surfacing 1,995 ft. of road in Patoka Twp. Address Alfred M. Johnson Co. Aud.

***Shelbyville, Ind.**—Bids will be received until July 6 by the Bd. of Comrs. of Shelby Co. for grading, draining and surfacing with crushed stone 9,400 ft. of road in Noble Twp.

Bids will be received until July 6 by the Bd. of Comrs. of Shelby Co. for grading, draining and surfacing with gravel 6,724 ft. of road in Van Buren Twp.

Bids will be received until July 6 by the Bd. of Comrs. of Shelby Co. for grading, draining and surfacing with gravel 14,295 ft. of road in Van Buren Twp. Address Walter W. Leslie, Co. Aud.

***Vernon, Ind.**—Bids will be received until July 5 by the Bd. of Comrs. of Jennings Co. for grading, draining and surfacing with crushed stone 12,715 ft. of highway in Columbia Twp.

Bids will be received until July 5 by the Bd. of Comrs. of Jennings Co. for the grading, draining and paving with crushed stone 13,542 ft. of road in Spencer Twp. Estimated cost $22,246. Address Everett Bemish, Co. Aud.

***Warsaw, Ind.**—Bids will be received until June 30 by Kosciusko Co. for improving roads, estimate $50,000. Address Tom J. Nye, Co. Aud.

***Winamac, Ind.**—Bids will be received until July 5 by the Bd. of Comrs. of Pulaski Co. for grading, draining and surfacing with gravel 3 mi. of road. Address J. C. Howe, Co. Aud.

***Washington, Ind.**—Bids will be received by the Bd. of Comrs. of Daviess until July 5 for the construction of the John Keith Bridge, Steel Twp.; McGrath Bridge, Barr Twp.; Bothwell Bridge, Reeve Twp.; Cooper Bridge, Madison Twp. Address Daniel I. Myers, Co. Aud.

Shreveport, La.—Bids will be received until July 5 by city for paving streets, involving 17,946 sq. yd. asphaltic concrete, including concrete curbing and guttering, 1,261 sq. yd. brick paving, 10,261 lin. ft. concrete curbing, 350 lin. ft. 18 in. vitr. pipe in place, 90 lin. ft. 15 in. concrete pipe in place, 10 catch basins, 5 cu. yd. concrete. Address H. E. Barnes, City Engr.

Pittsfield, Mass.—City plans to resurface East St.; estimate $160,000. Address A. B. Farnham, City Engr.

Salem, Mass.—City plans to pave with granite block on concrete base North St.; estimate $100,000. Address G. F. Ashton, City Engr.

Albert Lea, Minn.—Bids will be received until July 12 by Freeborn Co. for grading and draining 7 mi. of road, involving 50,247 cu. yd. excavation, 1,303 lin. ft. culverts, estimate $26,000. Address E. H. Brown, Co. Engr.

St. Paul, Minn.—Bids will be received until July 5 by Ramsey Co. for grading and paving with concerte 2 mi. of road, estimate $60,000. Address G. J. Ries, Co. Aud.

Booneville, Mo.—Bids will berecieved until July 5 by city for paving 8th St. between Morgan and Spring Sts. with brick on concrete foundation, estimate $50,000. Address C. G. Miller, Clk.

Jefferson City, Mo.—Bids will be received until July 5 by city for resurfacing Harrison St. Between Main and Water Sts. with bituminous macadam or Kentucky rock asphalt. Address L. F. Browan, City Engr.

Jefferson City, Mo.—State Highway Dept. plans to build 1.92 mi. of road in Macon Co., estimate $25,000. Address A. Graham, State Highway Engr.

St. Joseph, Mo.—Buchanan Co. will soon receive bids for grading, building bridges anp paving with concrete 6.64 mi. of road, estimate $373,000. Address J. D. Mohler, Engr.

Concord, N. H.—Bids will be received until July 6 by State Highway Comn. for surfacing with gravel or crushed gravel 1.42 mi. of road in Barrington. Address F. E. Everett, State Highway Comr.

Lambertville, N. J.—Bids will be received until July 9 by city for 18,195 sq. yd. sheet asphalt on macadam base. Address I. M. Smith, City Clk.

Morristown, N. J.—Morris Co. plans to build several roads. Address W. H. Hopins, Co. Engr., Dover.

Buffalo, N. Y.—Bids will be received until July 5 by city for paving 1,077 ft. Mendola St.; 989 ft. Haven St.; 794 Armbruster St.; 1,930 ft. Bowdoin St.; Kiefer

St. between Warden Ave. and Genesee St. Address G. H. Horton, City Engr.

North Tonawanda, N. Y.—City plans to pave various streets, estimate $113,000. Address C. L. Oelkers, City Engr.

***Middletown, N. Y.**—Bids will be received until July 5 by City for paving Monhagen Ave., Harding St., Fulton St., Sterling St. and West Main St., involving 23,500 sq. yd. of pavement. Address John A. Korschen, Comr. of Pub. Wks.

***Little Valley, N. Y.**—Bids will be received until July 6 by town for paving Court St., involving 6,723 sq. yd. vitr. brick, 960 cu. yd. concrete base and 4,564 lin. ft. curbing and guttering. Address D. J. Pushnell, Clk.

Raleigh, N. C.—Plans are being prepared for clearing, draining and top soiling 17 mi. of road in Alamance Co., estimate $100,000; 8 mi. in Guilford Co., estimate $24[illegible]; 6.5 mi. in Rutherford Co., estimate $[illegible],000; hard surfacing 8 mi. in Wake Co., estimate $250,000; grading, draining and surfacing 2.5 mi. in Craven Co., estimate $75,000; 18 mi. in Pender Co., estimate $100,000; 16 mi. in Duplin Co., estimate $50,000, 16 mi. in Edgecombe Co., estimate., $400,000. Address W. S. Fallis, State Highway Engr.

Yukon, Okla.—City plans to pave various streets with concrete, estimate $40,000. Address Sutton & James, Engrs., Oklahoma City.

***Akron, O.**—Bids will be received until July 5 by city for paving various streets. Address E. A. Kemmler, Engr.

***Cleveland, O.**—Bids will be received until July 1 by city for grading and paving streets, estimate $52,000. Address R. Hoffman, City Engr.

***Dayton, O.**—Bids will be received until July 6 by Montgomery Co. for paving 5,000 ft. of Germantown St., estimate $56,000. Address P. S. Bookwalter, Co. Surv.

***Portland, Ore.**—Bids will be received until June 29 by State Highway Dept. for grading 14.7 mi. of road in Umatilla Co., involving 90,000 cu. yd. excavation; 9.7 mi. in Lincoln Co., involving 66,000 cu. yd. excavation; 8 mi. of road in Coose Co., involving 90,000 cu. yd. excavation; paving 9.8 mi. in Josephine Co.; draining and widening 15.7 mi. in Washington and Yamhill Cos.; redressing 5 mi. in Tillamook Co.; surfacing with macadam 7.8 mi. of road in Jefferson Co. Address Herbert Nunn, State Highway Engr.

***Brownstown, Pa.**—Bids will be received until July 8 for 3,100 ft. brick road. Address H. Smith, Clk.

***Lewiston, Pa.**—Bids will be received until July 4 for paving with brick or tarvia 4,701 sq. yd. pavement. Address C. C. Brown, Engr.

***Mifflin, Pa.**—Bids will be received until July 1 for paving and curbing 4,000 ft. Jauniata St., concrete, estimate $50,000.

***Philadelphia, Pa.**—Bids will be received by city until June 29 for paving and bridge work; estimated cost $1,240,000. Work includes the following: paving with asphalt, Fairhill St. between Grange and Nedro Sts., 6th St. between Grange and Nedro Sts., Harrocks St. between Harrison and Wakeling Sts.; repaving with redressed granite block, Delaware St. between Vine and Fairmont Sts., Germantown St. between Front and Montgomery Sts., Grays Ferry between South and Federal Sts., Ridge St., between Columbia and Susquehanna Sts., Ridge St. between Indiana St. and School House Lane, Ridge St. between School House Lane and Main St., Main St. between Ridge and Harvey Sts., Woodland St. Between 34th and 39th Sts., Woodland St. between 41st and 50th Sts., 6th St. between Wharton and Synder Sts., 5th St. between Wharton and Synder Sts., 5th St. between Oxford and York Sts., 5th St. between Allegheny and Erie Sts., 6th St. between Allegheny and Erie Sts., 6th St. between Oxford and York Sts., 6th St. between York and Allegheny Sts.; asphalt repaving, 22nd St. between Norris and Lehigh Sts.; furnishing and delivering material for repairs to bridges, Tabor Road Bridge over Tacony Creek and Walnut St. Bridge over Schuylkill River. Address Frank H. Craven, Director of Pub. Wks.

Abbeville, S. C.—Bids will be received until July 7 for top soiling 16.50 mi. of road. Address H. B. Humbert, Co. Engr.

Nashville, Tenn.—Bids will be received until July 8 by State Highway Comn. for building 15.31 mi. of road in Carroll and Weakly Cos., involving 16,019 cu. yd. common excavation, 173 cu. yd. concrete and bridges on project involving 1,634 cu. yd. dry and 1,112 cu. yd. wet excavation; 10.01 mi. of road in Marion Co., involving 74,212 cu. yd. common and 28,048 cu. yd. rock excavation, 800 cu. yd. concrete. Address D. Q. McComb, Chief Engr.

Cameron, Tex.—Plans have been prepared by Milam Co. for grading, draining and surfacing 1.85 mi. of road, estimate $27,000. Address A. F. Mitchell, Co. Engr.

Canyon City, Tex.—Bids will be received until July 11 by city for improvement of various streets, involving 865 cu. yd. excavation, 302 cu. yd. borrow, 2,565 lin. ft. broken stone drain, 8,915 sq. yd. vert. fiber brick on 5 in. concrete base, 384 ft. oak headers, 1 catch basin. Address C. L. Hasie, Engr., Littlefield.

Center, Tex.—Plans have been prepared by Shelby Co. for grading and surfacing 16.87 mi. of road, estimate $484,505. Address J. B. Burns, Co. Judge.

Comanche, Tex.—Plans have been prepared by Comanche Co. for grading, draining and surfacing with bituminous macadam 4.6 mi. of road, estimate $121,874. Address L. D. Parks, Engr., De Leon.

Gonzales, Tex.—Bids will be received until July 9 by Gonzales Co. for grading and surfacing 12.04 mi. of road, involving 26,345 cu. yd. gravel, 2,405 cu. yd. concrete, estimate $163,189. Address J. W. Benjamin, Co. Engr.

Kingsville, Tex.—Bids will be received until June 30 for graveling highway No. 12, estimate $72,109. Address B. F. Wilson, Co. Judge.

Waxahachie, Tex.—Bids will be received until July 8 by Ellis Co. for grading and surfacing with gravel 4.23 mi. of road, involving 14,903 cu. yd. gravel, 12,599 cu. yd. earth excavation, 11,906 lb. reinforcing steel, estimate $76,335; graveling 7 mi. of road (gravel furnished by county), estimate $154,657. Address G. G. Edwards, Co. Engr., Ennis.

Green Bay, Wis.—Bids will be received until June 29, by State Highway Comn. at division office in Green Bay, for clearing and grading 4.43 mi. of road in Marinette Co., involving 29,995 cu. yd. earth and 271 cu. yd. borrow excavation and 131.8 cu. yd. concrete. Address A. R. Hirst, State Highway Engr., Madison.

Mayville, Wis.—Bids will be received until June 30 by city for paving streets, involving 14,390 sq. yd. warrenite on concrete base, 10,643 lin. ft. concrete curb and 2,330 cu. yd. grading. Address J. Donahue Eng. Co., Engrs.,Sheboygan.

Montreal, Que.—Bids will be received until July 7 for paving 1 mi. Sherbrooke St. with bituminous macadam, estimate $57,281; 1 mi. Sanguinet St., estimate $57,690. Address A. E. Doucet, City Engr.

Bids Received and Contracts Awarded

Girard, Kan.—Crawford Co. let contract for grading, draining and paving 4.26 mi. of road to Independent Const. Co., Pittsburg, Kan., at $179,261.

Leavenworth, Kan.—Leavenworth Co. let contract for paving 4.41 mi. of road to Missouri Valley Bridgt Co., Leavenworth, at $143,058.

Augusta, Me.—State Highway Dept. let following contracts: draining and surfacing with bituminous macadam 5.27 mi. of road in Lisbon, to Thomas & Murphy, Keene, N. H., at $145,705; 3.96 mi. of road with gravel surfacing in Silver Ridge to M. Hughes, Bangor, at $86,616; graveling 3.23 mi. of road in Stockton Springs to Arborio Co., Hartford, Conn., at $59,811; 2.87 mi. of bituminous macadam in Oakland and 2.54 mi. in Belfast to A. D. Bridges Co., Hazardville, Conn., at $78,849 and $110,550.

Lansing, Mich.—State Highway Comn. awarded following contracts: 0.88 mi. of bit. paving in Houghton Co. to Houghton Co. Rd. Comn., at about $42,000; 10.34 mi. in Marquette Co. of Macadam to Houghton Co. Rd. Comn., at $221,250; 2.51 mi. of gravel road in Ontenagan Co. to McDonnel & McFarlane, Duluth, Minn., at $100,430; 0.20 mi. of 20 ft. concrete road in Ingham Co. to Ingham Co. Rd. Comn., at about $7,129.

Maplewood, Mo.—City let contract for paving Elm St. between Arbor and Sutton Sts. with rein. concrete to C. M. Berry, Webster Groves, at $25.680.

Abescon, N. J.—Atlantic Co. let contract for paving 5.75 mi. of warrenite on concrete base to C. H. Earl, Hackensack, at $395,556.

Trenton, N. J.—State Highway Dept. let contract for 46,630 sq. yd. sheet asphalt on concrete base on Route 4, Sect. 5, to Newark Paving Co., at $242,997; grading and graveling 75,700 sq. yd. New Lisbon Rd. to A. J. Melmoe, Newark, at $59,370.

Woodbury, N. J.—Gloucester Co. let contract for resurfacing with asphalt 2.5 mi. of road to Union Paving Co., Philadelphia, at $50,300; graveling and grading 58,992 sq. yd. of road to L. J. Sieling, Red Bank, at $60,000.

Ashley, N. D.—Contract let by McIntosh Co. for grading 11 mi. of road to J. Herr, Jr., Ashley, at $33,466.

Harrisburg, Pa.—The State Highway Dept. on June 21 received the following bids:

Bradford Co., 10,500 ft. Bit. surface on concrete base or 1 course concrete, Frank G. Fowler Const. Co., Mt. Kisco, N. Y., $106,615; R. D. Richardson Const. Co., 828 Connell Bldg., Scranton, $115,029.

Bucks Co., 44,656 ft. 1 course concrete and Hillside brick, W. C. Evans, Ambler, $466,610; Mason & Hanger Co., Gettysburg, $592,277; The Cranford Paving Co., Washington, D. C., $540.801; Benjamin Foster Co., 20th and Venango Sts., Philadelphia, $505,110.

Chester Co., 21,285 ft. 1 course rein. concrete, Sutton & Corson Co., 9th and Simpson Ave., Ocean City, N. J., $344,944; Winston & Co., 58 High St., Pottstown, rejected; Charles H. Dunleavy, 9 Pennegar Bldg., Coatesville, $318,747; Ambler Davis Co., Philedelphia, $310,369.

Clinton Co., 3,928 ft. 1 course rein. concrete, Johnson & Kearns, 5 W. Long Ave., DuBois, $72,253; John C. Shrade, 193 Beach 108th St., Rockaway Beach, N. Y., $92,372; Synder Philips Co., 273 W. Mt. Pleasant Ave., Philadelphia, $76,053; John M. Hutchinson, Altoona, $83,335; George I Thompson Co., Clearfield, $86,361; W. J. and J. T. Gephart, Linden, $66,962; Miller Const. Co., Punxsutawney, $70,586; Frank Murphy, 2635 W. Chestnut Ave., Altoona, $79,530.

Crawford Co., 24,787 ft. bit. surface on concrete base or 1 course rein. concrete, Walter Derr, Box 92, Norristown, $247,786; Mohawk Paving Co., 2 Chestnut St., North Adams, Mass., $288,581; C. E. Walter, Butler $275,491; H. P. Streicher Co., 319 Terminal Bldg., Toledo, O., $270,547; Standard Paving and Cont. Co., 1361 W. Lake Ave., Lakewood, O., $262,887; Kennedy Bros., 1,807 Ohio Ave., Youngstown, O., $268,733; Carey Campbell & Co., 96 Wall St., N. Y. City, $279,930; Samuel Gamble Co., Carnegie, $267,930; Seiple Wolf Const. Co., 707 Wick Bldg., Youngstown, O., $267,816; Bates & Rogers Const. Co., 37 W. Van Buren St., Chicago, Ill., $282,816; J. C. Devine Co., Alliance, O., $269,814; McCrady Bros. Co., 308 6th St., Braddock, $252.566.

Erie Co. 13,278 ft. bit. surface on concrete base or 1 course rein. concrete, Kennedy Bros., 1807 Ohio Ave., Youngstown, O., $136.548; Smethport Const. Co., Smethport, $151,292.

Fayette Co., 14,486 ft. 1 course rein. concrete and hillside brick, Petriello Bros & Co., 3 Snowden Bldg., Brownsville, $208.194; Vincenzo DiGiorno, Fayette City $183,659; R. Galiardi & Sons, 279 E. Fairview Ave., Connellsville, $164,877; McCrady Bros. Co., Braddock, $193.236; Edward C. Cornish, Uniontown, $203,095; Jones Const., Salem, O., $186,654.

Huntington and Blair Cos., 4,168 ft. 1 course rein. concrete, R. D. Richardson Const. Co., Scranton, $142,415; M. A. Dively Const Co., Claysburg, $160,072; Sheesley & Jonney Const. Co., Johnstown, Pa., $154,964; Leo E. Kelly Co., 189 Montague St., Brooklyn, N. Y., $179,733; Burgess & Dorrier, Scottsville, Va., $142,483; Dowler & Anderson, Clearfield, $158,442; J. C. Mickey, 1601 Ligonier St., Latrobe, $173,570; John L. Elder, Ebensburg, $161,016; Bennett & Randall, Lebanon, $150,195; John M. Hutchinson, Altoona, $166,853; O. B .S. Co., 5623 Kingsessing Ave., Philadelphia, $156,136.

Lancaster Co., 3,144 ft. 1 course rein. concrete, Michael Rosatto and Son Co., 1145 Cloan Ave., Scranton, $30,792; Henry

ROAD BUILDERS' EXCHANGE

Special
Road Building Equipment

1—8 ton Kelly-Springfield Tandem Roller with Mass. Specification boiler.
1—10 ton 3 wheel new Huber roller with steam scarifier.
1—600 gallon Studebaker Sprinkling Wagon.
1—600 gallon Steel Sprinkling Wagon.
2—Pioneer Dryers complete each 3 ft. 6 in. x 16 ft., like new.
1—Semi-portable asphalt plant with Cummer dryer.
2—500 gallon asphalt kettles on wheels.
1—40 H. P. Ames Boiler on wheels with engine on frame.
1—6-A Foote Concrete Mixer traction drive.
1—No. 3 Keystone Shovel, complete.
1—Model 0 Thew Steam Shovel complete.
1—Gasoline driven compressor, 100 cu. ft. capacity.
1—2½ Climax Portable Crusher, complete with bins, screens, boiler. engine, etc.
100 tons Concrete Reinforcing Rods, ¼ in. to 1 in.

The above items are picked at random from a very complete line of road builders' equipment which I have. Let me know your requirements.

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150 Nassau St. New York City
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Reasonably ROAD BUILDING PLANT Priced

3500 ft. Lakewood, 20 lb. 24 in. ga. portable track, 8 extra heavy pressed steel ties riveted to each 16 ft. 6 in. section. Used only demonstrating. Like new, repainted.
7500 ft. Koppel 20 lb. 24 in. gauge portable track, 6 steel ties per 15 ft. section, clip and bolt type, practically new.
25,000 ft. Koppel 20 lb. 24 in ga. portable track, 15 ft. section part clutch bolt and part clip and bolt type, good condition.
12 Lakewood switches for above, right and left hand. 20 lb. 24 in. ga., total length per switch is 28 ft. 6 in., each in 4 sections. Good as new.
8 Lakewood 1½ yd. 24 in. ga. V body dump cars, ex. heavy type, cat. style No. 241.
10 Koppel 36 cu. ft. 24 in. ga. V body cradle dump cars with brakes.
35 Koppel 36 cu. ft. 24 in. ga. V body cradle dump cars without brakes.
10 Pressed Steel Car Co. all steel, 11 ton cap. flat cars, decks are 20 ft. clear. in length. Spring mounted, 8 wheels, with brakes. Brand new.
3 7-ton Baldwin gasoline locomotives, 24 in. ga., 50 hp., 4 cyl. engines, self starters, electric lights and signals. Two speeds either direction, gear transmission, multiple disc clutch. Send for photo. Guaranteed good as new.
1 6-ton American steam locomotive, 24 in. gauge, saddle tank, 6 x 10 cyl.
1 6½-ton Koppel steam locomotive, 24 in. gauge, 20 hp., 6 x 11 cyl.
2 8-ton Koppel steam locomotives, 24 in. gauge, 30 hp., 6¾ x 11 cyl.
1 9-ton Vulcan steam locomotive, 24 in. gauge, saddle tank, 7 x 12 cyl.
1 600-gallon Hvass road oil distributor, complete.
1 10-ton Buffalo-Pitts steam road roller, now going through the shops.
1 No. 9¾ D, Acme rock crushing plant, jaw openings 11 x 20 in., portable, with folding elevator and revolving screens. Used only four months. Overhauled.
1 Byers Auto-Crane, caterpillar traction, steam driven, A.S.M.E. boiler, 35 ft. boom, ¾ yd. clam shell bkt., new 1920.
1 Erie type B traction steam shovel, has long boom, 2½ ft. longer than standard, 20 ft. dipper stick, ¾ yd. dipper and counterweights to balance for high lifts.
1 No. 3-A Cameron stm. pump for 2 in. line.
1 Fairbanks-Morse 6 hp. road force pump for 2 in. line.
1 Lidgerwood 7 x 10 D.C. D.D. hoisting engine and boiler.
1 Mundy, 6½ x 12 D.C., D.D. hoisting engine and boiler.
2 No. 16 and No. 22 Koehring paving mixers, in good order.
1 No. 3 Keystone shovel, purchased new last summer, both skimmer and ditcher scoops, bargain to quick purchaser.
1 Austin Scarifier.
1 Barber Green self feeder wagon loader.

Reading Engineering Company, Inc., 154 Nassau Street, New York City

E. Baton, 1713 Sansom St., Philadelphia, $33,307; Souder Const. Co., 349 Woolworth Bldg., Lancaster, $34,004; Sutton Cont. Co., 1207 Vine St., Philadelphia, $31,533; J. Miller Eshleman, Landisville, $31,627.

McKean Co., 6,565 ft. 1 course rein. concrete, Michael Rosatto & Son Co., Scranton, $78,286; Fred D. Ross, 74 High St., Bradford, $75,166; Minns Bros., DuBois, $96,106; Warren Moore & Co., Colonial Trust Bldg., Philadelphia, $98,165; Mason & Hanger Co., Bettysburg, $88,037; Smothport Const. Co., Smethport, $82,752.

Northumberland Co., 18,957 ft. bit. surface on concrete base or 1 course rein. concrete, R. W. Savidge & Co., Sunbury (Spec. A) $219,399; Comeford Const. Co., Philadelphia, $246,933; Henry W. Horst, Rock Island, Ill., $271,188; G. W. Rockwell, Sunbury, $254,784; John C. Shrade, Rockaway Beach, N. Y., $234,414.

Schuylkill Co., 10,688 ft. 1 course rein. concrete, bit. surface on concrete base or vitr. brick, W. C. Evans, Ambler, $164,381; John V. Cummins, 20 Gowen Ave., Philadelphia, (Spec. D), $167,817.

Schuylkill Co., 2,749 ft. bit. surface on concrete base or bi.t macadam on broken stone base, W. C. Evans, Ambler, (Spec.A) $61,307.

Tioga Co., 41,843 ft. bit. surface on concrete base or 1 course rein. concrete, Horn & Devling, Galeton, $559,942; Bennett & Randall, Lebanon, $549,838; Comerford Const. Co., Philadelphia, $521,267; Henry W. Horst Co., Rock Island Ill., $549,371; J. C. Bradley Co., Wellsboro, $604,747; Greene Hine Co., 345 E. 33rd St., N. Y. City, $524,912; M. Bennett & Sons, Indiana, Pa., $517,959.

York Co., 5,786 ft. bit. surface on concrete base or 1 course rein. concrete, A. B. Kraft, 511 So. Water St., York, (Spec. A), $89,776; Continental Cont. Co., Knickerbocker Bldg., Baltimore, Md., $108,233.

Warren Co., 17,604 ft. 1 course rein. concrete, H. C. Howe, Sherman, N. Y., $159,274; Fred C. Chiodo, Sheffield, $182,115; J. C. Devine Co., Alliance, O., $177,902; C. E. Walter & Co., Clarion. $182,657; Burgess & Dorrier, Scottsville, Va., $177,889; Smethport Const. Co., Smethport, $192,020; Elmer Love & Son, Corry, $170,941; Bates & Rogers Const. Co., Chicago, Ill., $182,336.

Providence, R. I.—State Bd. of Pub. Wks. let contract for 6.64 mi. of bituminous concrete in South Kingstown to A. D. Bridges Sons, Hazardville, Conn., at $156,059.

Montipelier, Vt.—State Highway Dept. let contracts: 2.03 mi. gravel in Irasburg to Streetsr & Sons., Worcester, Mass., at $38,629; 2 mi. bituminous macadam in Guilford to Arborio Co., Hartford, Conn., at $43,901; 1.2 mi. concrete in Rutland to P. C. Ricci, at $39,011; 0.89 mi. concrete road in Bennington to F. T. Ley & Co., Springfield, Mass., at $41,422.

BRIDGES

Bids Asked and Prospective Work

Prattville, Ala.—Augusta Co. plans to construct bridge across Alabama River at Reeves Ferry; estimate $200,00. Address Co. Clk.

Los Angeles, Cal.—The Bd. of Supvrs. of Los Angeles Co. are preparing plans for 550 ft. rein. concrete bridge over Rio Hondo; estimate $130,000.

New Haven, Conn.—City plans to build rein. concrete bridge over Quinnipac River; estimate $400,000. Address E. S. Nettleton, City Engr.

Atlanta, Ga.—City is planning to build viaduct connecting Marietta St. with Terminal Station Plaza. Address City Clk.

***Anderson, Ind.**—Bids will be received until July 5 by Bd. of Comrs. of Madison Co. for the construction of a rein. concrete pier, bridge top and seats on abutments now in place at Washington St., Alexandria; estimate $6,713. Address Henry P. Hardie, Co. Aud.

Wichita, Kan.—City plans to build bridge at Maple St.; estimated cost $165,000. Address P. L. Brockway, City Engr.

Fairmont, Minn.—Bids will soon be received by Martin Co. for the construction of bridges and culverts: Bridge No. 3553, Fox Lake Twp., involving 256 cu. yd. concrete, 24,985 lb. reinforcing steel, 1,840 lin. ft. piling; Bridge No. 3554, involving 1,761 lb. steel. Address H. C. Nolte, Co. Aud.

Fairbault, Minn.—City plans to build bridge over Cannon River; estimate $28,000. Address F. W. McKellip, City Engr.

Marshall, Minn.—City plans to build bridge over Redwood River; estimate $26,000. Address J. H. Brahtz, Engr.

***Helena, Mont.**—Bids will be received until July 6 by the State Highway Comn. for the construction of Noxon Bridge in Sanders Co. Work involves, Approaches, 16,300 cu. yd. excavation, 2,500 cu. yd. overhaul, 94 lin. ft. 18 in. pipe culverts, 3 cu. yd. class B concrete in headwalls, 12 m. ft. lumber, 4 acres clearing; bridge, 446,000 lb. structural steel, 185 lb. structural steel in floor joists, 86,000 lb. steel tubular piers, 132 m. ft. timber, 1,391 cu. yd. concrete, 5,000 lin. ft. timber piling, 11,000 lb. reinforcing steel, 700 cu. yd. excavation. Address John N. Edy, Chief Engr.

***Grafton, N. C.**—Bids will be received by Lenoir Co. until July 5 for the construction of a steel bridge over Neuse River, estimate $30,000. Address R. R. Eagle, Engr., New Bern.

Charlotte, N. C.—Mecklenburg and York Co., S. C., plan bridge over Catawba River; estimate $160,000.

***Kinston, N. C.**—Bids will be received until July 5 by the Co. Comrs. of Lenoir Co. for the construction of a steel bridge

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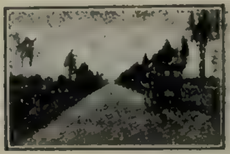

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across Neuse River, near Grifton. Address R. R. Eagle, Co. Engr., New Bern.

***Beach, N. D.**—Bids will be received until July 5, by Billings Co. for the construction of two bridges. Address M. C. McCarthy, Co. Aud

***Trenton, N. J.**—Bids will be received until July 6 by State Highway Comn. for repairing steel bridge over Matawan Creek in Monmouth Co. Address C. A. Mead, 790 Broad St., Newark, State Bridge Engr

***Catskill, N. Y.**—Bids will be received until July 11 by town for building steel bridge over Cauterskill Creek. Address G W. Swartwout, Clk.

Conneaut, O.—Ashtabula Co. is planning to build 1,100 ft. bridge; estimate $600,000 Address Co. Engr.

***Fremont, O.**—Bids will be received until July 12 for the construction of five span rein. concrete bridge over Sandusky River, 447 ft. long and 61 ft. wide. Estimated cost, $250,000. Address Co. Clk.

***Mitchell, S. D.**—Bids will be received until July 5 by Davison Co. for the following bridges: one 24 ft. rein. concrete beam slab bridge on 14 ft. abutments; one 20 ft. rein. concrete beam slab bridge on 15 ft. abutments; one 20 ft. rein. concrete beam slab bridge on 15 ft. abutments; one 20 ft. rein. concrete beam slab bridge on 14 ft. abutments. Address W. O. Crampton, Co. Aud.

Gilmore, Tex.—Plans are being prepared by Upsur Co. for bridges. Address H. S. Wilder, Co. Engr.

***Olympia, Wash.** Bids will be received until July 1 for the construction of rein. concrete bridge on federal aid project No. 42. Address James Allen, State Highway Comr

Sheridan, Wyo. City is planning to build two bridges Address City Engr.

Bids Received and Contracts Awarded

Bridgeport, Conn.—City let contract for repairing Congress St. Bridge over Pequonnock River to A. G. Leake Co., Bridgeport, at about $40,000.

Belleville, Kan.—Republic Co. let contract for building Pawnee Bridge to Pioneer Const. Co., Kansas City Mo., at $72,814.

Lansing, Mich.—City let contract for 147 ft. concrete bridge on Pennsylvania Ave. to Hannemann Bros., Detroit, at $72,814.

Cleveland, O.—Cuyahoga Co. let contract for concrete bridge over Solon Rd. to Rice-Jones Co., Cleveland, at $39,158.

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OFFICE OF THE STATE COMMISSION OF HIGHWAYS, ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock p.m., advanced standard time which is twelve o'clock noon eastern standard time, on Wednesday, the 6th day of July, 1921, for the improvement of highways in the following counties:

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Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose division the roads are to be improved or repaired. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specification and contract agreement.

HERBERT S. SISSON,
Commissioner.

J. C. FINCH,
Acting Secretary.

HIGHWAY WORK

Notice to Contractors

OFFICE OF THE STATE COMMISSION OF HIGHWAYS, ALBANY, N. Y.

SEALED PROPOSALS will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at one o'clock p. m., advanced standard time which is twelve o'clock noon eastern standard time, on Wednesday, the 13th day of July, 1921, for the improvement of highways in the following counties:

Chautauqua ....(two highways: 1.32 & 2.94
Cortland ....(approx. 3.67)
Delaware ....(approx. 4.98)
Greene ....(two highways: 4.13 & 3.98)
Ontario ....(two highways: 3.20 & 8.81)
Rensselaer ......(two highways: 1.95 & 5.46)
St. Lawrence....(two highways: 5.74 & 6.45)
Seneca ....(approx. 3.20)
Steuben ....(two highways: 4.03 & 2.85)
Yates ....(approx. 8.81)

ALSO FOR THE REPAIR OF HIGHWAYS IN THE FOLLOWING COUNTIES

Erie ....(one contract)
Genesee ....(one contract)
Jefferson ....(one contract'
Westchester ....(one contract)

Maps, plans, and specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose division the roads are to be improved or repaired. The address of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "Special Information for Bidders" in the itemized proposal of specifications and contract agreement.

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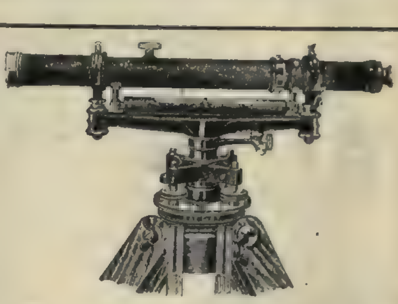

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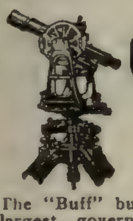

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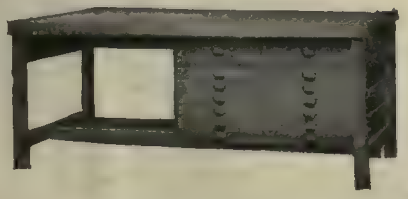

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Complete copy and cuts for covers must be in the office of publication at least one week previous to publication date. Copy for run-of-paper advertising must be in hand not later than ten days preceding date of publication, where proof is required. Right is reserved to repeat last advertisement when new copy is not furnished at the time stated.

The publisher will not be responsible for the use of wrong cuts unless proofs of same are pasted on orginal copy.

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Annex

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